FRIDAY, MAY 25, 1883.

INTERNATIONAL BUREAU OF WEIGHTS AND MEASURES.

IN compliance with the requirements of the nineteenth article of the regulations, the international committee of weights and measures has issued its report for the year 1882, and of the present condition in the progress of its important work. It is the most satisfactory report so far made; and it shows every thing to be in such good order, and working so well, that the delivery of the international standards may be expected to be begun during next year. To the present time the progress has necessarily been slow, as the important questions of means and methods had to be carefully considered before adoption. Now, however, we see the methods settled, the means at hand, and the contracts let for the delivery of the bars for the international metres, and the ingots for the kilograms.

The report covers the operation of the calendar year 1882. During the year important advances were made in the instrumental outfit. The universal comparator, which was ordered in 1877, and was for four years in process of construction by Starke & Kammerer in Vienna, was received at Breteuil in November, and is now undergoing a thorough examination and testing of all its parts, previous to its use in determining the values of the new line metres.

A contract has been entered into, between the bureau and the *Société génevoise pour la construction d'instruments de physique et de mécanique*, for the delivery, by the latter, of a comparator for testing base bars, whether of line or end measure, of lengths up to and including four metres; the outfit of the comparator to include two four-metre line-standards, each subdivided into single metres by lines drawn on platinum-iridium plugs inserted at proper intervals. These standards are to be of wrought iron, T-shaped in cross-section. In addition to the subdivision into metres, one of these standards is to have two additional lines 0.051 metre within the four-metre lines (the space so marked serving as a double-toise standard), and two lines 0.060 metre without the four-metre lines (this space serving as the standard for comparison of four-metre end-measures by the use of contact cylinders). The contract price for this apparatus, delivered and mounted, is 34,000 francs. It is to be delivered at Breteuil before the end of July of this year.

The balance for vacuum weighings was received, but certain defects in its construction required it to be returned to the maker for alteration. Unhappily the condition of his health has delayed the necessary work; and, as it did not seem probable that he would be able soon to give the matter his personal attention, the execution of the details of alteration has been intrusted to other hands, and it is expected that the balance will be in satisfactory working-order before the end of the present year. Under the care of M. Marek, the other balances have been placed in position; and every thing is in readiness for the weighings in air and for the hydrostatic weighings.

The Fizeau expansion apparatus has been so modified as to admit of experiments in vacuum, and the tests of the modified apparatus have been most satisfactory. From the observations for the expansion of the platinum-iridium tripod of the apparatus, data were obtained for ascertaining, more surely than ever heretofore, the index of refraction of air between 0° and 80° C.

The air-thermometer apparatus has been perfected; and it is hoped that the comparisons of thermometers, retarded by the illness of Dr. Pernet, will soon begin.

The contract for furnishing the bars for the metres, and the ingots for the kilograms, has been given to Messrs. Johnson, Matthey, & Co., of London. This house agrees to furnish thirty bars, ×-shaped, and further specified as follows: the length to be 1.20 metres; the density, not less than 21.5; the alloy to be such, that, in 100 parts, there shall be not less than 89.75 nor more than 90.25 parts of platinum, and not less than 9.75 nor more than 10.25 of iridium, with a tolerance of 0.1 iron, 0.1 ruthenium, 0.15 rhodium and palladium,

and 0.02 gold and silver. The bars are to be of homogeneous metal, entirely soluble in *aqua regia*, and of uniform density. This density is to be ascertained from two specimens taken from the two ends of the bar. Before making the alloy, there shall be taken, from a mass of at least 20 kilograms, two specimens of each metal; and the same shall be done with the alloy before proceeding to make the bars or kilograms. These specimens will then be sent to a member of the international committee at Brussels, and to a member of the French section at Paris, respectively, for independent analysis; and the work shall not proceed until these specimens are examined and approved. The bars shall present no defects which will not disappear in the finishing; and this finishing shall not be undertaken until the rough bars have been submitted, examined, and accepted, provisionally, by the French section. Messrs. Johnson, Matthey, & Co., are left free to use their own judgment as to the best method of preparing the pure metal, of making the alloy, and of making the bars. If any bars are rejected, they shall be returned to the makers; and the French government shall not be held liable either for the labor expended or for the value of the metal.

Messrs. Johnson, Matthey, & Co., further agree to furnish forty ingots of the same metal for the construction of the international kilograms. Each piece is to weigh between 1.150 and 1.200 kilograms, and to be subject to the same conditions, regarding composition, alloy, and density, as the bars.

For this work the makers are to receive 2,000 francs per kilogram for the alloy accepted, 2,500 francs for work on each bar, and 150 francs for work on each kilogram. In part-payment, they are to take all unused alloy at the rate of 900 francs per kilogram, and the sample specimens sent to Brussels and Paris at the rate of 2,000 francs per kilogram.

Before undertaking the adjustment of the international standards, it was necessary to prepare authentic copies of the original prototypes. This delicate work was intrusted to two joint committees, composed of members of the international committee and of the French section, one having charge of the comparisons of length, and the other of those of weight. The comparisons were successfully made. The copies of the *mètre des archives* and of the *kilogramme des archives* are of platinum-iridium, fulfilling all the conditions above mentioned, as required for the new international standards.

On the 26th of April, 1882, there was held a meeting, at which were present the minister of commerce, the director of the international bureau, and five members of the international committee and French section. After a statement of the comparisons made, and results obtained, the type-metre and type-kilogram were, in the presence of the above-mentioned parties, formally delivered into the hands of M. Broch, the director of the international bureau, who, from that moment, was charged with the care, custody, and preservation, of these important articles. These types will serve as the standards for the international metres and kilograms; and the limit of error allowable in the marking and adjustment of the latter is fixed at ± 3 microns for the metre, and ± 0.2 milligram for the kilogram.

To hasten as much as possible the final adjustment of the international standards, it is ordered that the French section transmit each metre and kilogram as it is ready, without waiting for the preparation of the entire number. In this way the comparison and verification will be in execution by the international committee, while the tracing of the metres, and adjustment of the kilograms, are being done by the French section.

The construction and verification of the thermometers which are to accompany the standards will be the care of the international committee.

During 1882 the *personnel* of the international committee remained unchanged. The committee will, however, soon suffer a loss in the departure of one of its most able members, M. Marek, who leaves to accept a position in the Austrian bureau of weights and measures. The resignation of M. Marek was accepted, to take effect at the close of last year; but at

the urgent request of the committee, and by permission of the Austrian government, he remains a few months to attend to the printing of important papers, which will appear in the next volume of the *Travaux et mémoires* of the bureau, and to superintend the adjustment of the new universal comparator.

In the latter part of 1881 the kingdom of Roumania expressed a desire to subscribe to the regulations of the international commission, and is now numbered among the states represented in that body. The metric system is now used in all official transactions in Roumania; and on the 1st of January, 1884, its use will become compulsory throughout the kingdom.

RECENT EXPLORATIONS IN THE REGION OF THE GULF STREAM OFF THE EASTERN COAST OF THE UNITED STATES BY THE U. S. FISH-COMMISSION.[1]

1. Introductory.

ALTHOUGH several extended surveys along the region of the Gulf Stream had been made by the officers of the U. S. coast-survey since 1844, no systematic dredging had been done along its course, north of Florida, until 1880. During the previous surveys, large numbers of bottom samples had been saved. Some of these were studied many years ago by Professor Bailey, and later by Mr. L. F. de Pourtalès. Many of the Foraminifera and other microscopic forms have been described by them. A few small shells from the same source were described by Dr. A. A. Gould in 1862. These investigations gave a general idea of the nature of the materials of the bottom and the depth, but many errors existed in the earlier surveys in the determinations of temperature, and in many cases the recorded depths were unreliable. The extensive surveys made by the Blake, since 1880, have been conducted with much better apparatus and greater accuracy.

The real character of the fauna inhabiting the bottom beneath the Gulf Stream, off our coast, was completely unknown until 1880, when numerous and successful dredgings were made, first, by Mr. Alexander Agassiz, on the coast-survey steamer Blake (J. R. Bartlett, U.S.N., commanding), and, later in the season, by the U. S. fish-commission party, on the Fish Hawk. The Challenger, on her celebrated voyage, made a line of dredgings from Bermuda toward New York; but, on approaching our coast, she turned northward, and went to Halifax. Her station nearest to our coast was about 160 miles off New York, in 1,240 fathoms. This is much farther off the coast than any of the fish-commission dredgings, and outside the Gulf Stream slope. The few dredgings made by the Challenger off Halifax were partly on the shallow fishing-banks (Le Have bank), and partly in the deep water of the Atlantic basin. By mere chance, therefore, the Challenger missed the discovery of the exceedingly rich and varied deep-water fauna that is now known to occupy the Gulf Stream slope all along our coast. In 1872 one haul was made by Messrs. S. I. Smith and O. Harger, on the Bache, in 430 fathoms, south of George's bank, on this slope; but it happened to be on a comparatively barren spot. In 1877 the U. S. fish-commission party dredged on the northward continuation of the slope, about 120 miles south of Halifax, in 90 and 190 fathoms; but the bottom was of barren gravel, and the results meagre and unsatisfactory. In that region the cold currents are rapid, and the slope of the bottom is exceedingly steep, making the dredging very difficult. In 1880 Mr. A. Agassiz, while on the Blake, made several lines of dredgings off our eastern coast, crossing the Gulf Stream slope. The most southern of these were off the Carolina coasts, and the most northern stations were just south of George's bank. These dredgings extended from shallow water to 1,632 fathoms. The Blake was furnished with excellent apparatus for sounding and dredging, temperature determinations, etc. The officers of the Blake secured by this exploration a large amount of reliable physical data; and Mr. Agassiz obtained very interesting collections, including large numbers of new forms of animal life, many of which have already been described in the bulletin of the Museum of comparative zoölogy.

Later in the season of 1880, the U. S. fish-commission dredging-party, under the direction of the writer, made its first expedition to the Gulf Stream slope in the steamer Fish Hawk (Lieut. Z. L. Tanner commanding). The region visited was about 75 to 80 miles south of Martha's Vineyard, in 65 to 192 fathoms. On Sept. 4, when this ground was first visited by us, a long day was spent in dredging and trawling, and with marvellous results. The bottom was found to be occupied by an exceedingly rich and abundant fauna, including great numbers of new and strange forms of

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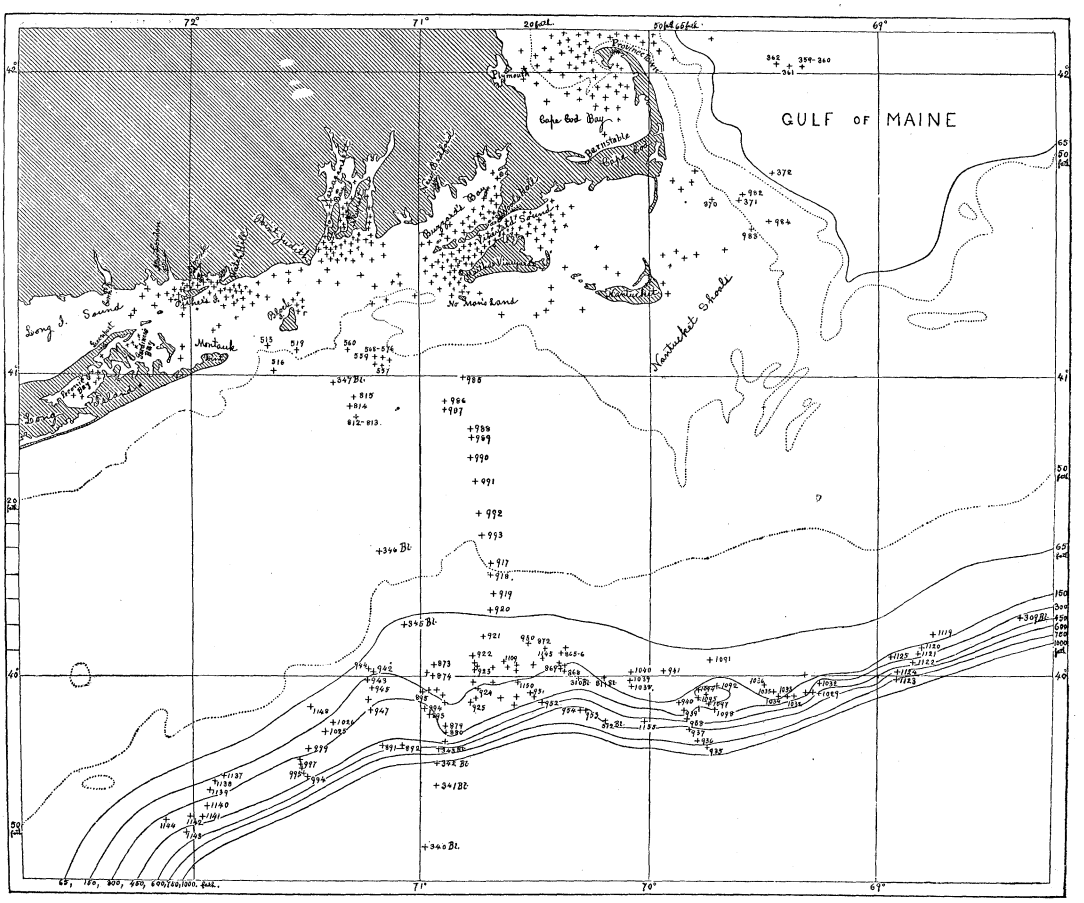
animals belonging to nearly all the marine orders. Many fishes never before taken on our coast were secured. Thousands of beautiful and undescribed star-fishes of many species, with varied shapes and colors, encumbered our deck. Crabs and shrimps of strange kinds, some of them of large size, were taken by thousands. Numerous new and curious species



Map I. — Southern coast of New England to the Gulf Stream slope, showing lines of depth and the positions of the principal dredging-stations of the U. S. fish-commission, 1871, 1874, 1875, 1880–82. The crosses (+) indicate dredging-stations, part of which are accompanied by their serial numbers corresponding to the records and published lists. Those bearing numbers between 309 and 347 were occupied by the Blake in 1880.

though aided by the officers and sailors of the steamer, who shared more or less in our enthusiasm, — from daylight in the morning till late at night, to preserve what we had secured, notwithstanding we threw away many thousands of duplicates. Some idea of the richness of this fauna, and of the abundance of life on the bottom in this region, may be gathered from the fact that it required about five barrels of alcohol to preserve the portion of the catch that we saved on this one day, and a similar amount was used by us on various subsequent trips in a single day. On our first day eight hauls were made, mostly with a large beam-trawl. There was a very heavy swell, due to a violent cyclone that had prevailed farther south a few days before.

of shells, some of them very beautiful; bushels of large and brilliantly colored sea-anemones, several of them over a foot across, and most of them previously unknown; with sea-pens and corals of elegant forms and colors, — were among the more conspicuous treasures secured on that ever memorable day. So successful were we, that it required the most diligent and devoted labor on the part of our entire party,—

Under these circumstances, the dredging and the care of the specimens were unusually tiresome: otherwise our enthusiasm would, perhaps, not have allowed us to retire, even at midnight. But a touch of genuine seasickness will dampen the ardor even of the most enthusiastic naturalists when hundreds of new and strange species are before them.

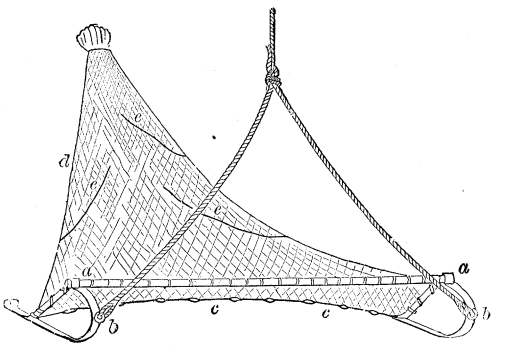


FIG. 1. — The beam-trawl. The length of the beam, *a*, *a*, varies from 12 to 15 feet in those used by us. The height of the iron runners, *b*, *b*, supporting the beam, varies from 24 to 30 inches; the length of the net, *d*, from 25 to 35 feet or more. The pockets, *e*, within the net, are to prevent the escape of fishes. The drag-rope, *c*, *c*, is weighted with lead sinkers.

This first trip having been so successful, two others were made, later in the season, to other parts of the slope, in depths ranging from 85 to 500 fathoms. Each trip proved equally productive, and added many species to the long list of discoveries.

In 1880 the headquarters of the fish-commission were at Newport, R.I.; but in 1881 and 1882 they were at Wood's Holl, Mass., where a laboratory had already been fitted up in 1875. In 1881 and 1882 the exploration of the Gulf Stream slope was continued, whenever the weather was sufficiently favorable to permit us to make a trip in the Fish Hawk without too much risk.

The steamer Fish Hawk, with which we have explored this region during the past three seasons, was built particularly for use in the hatching of shad-eggs in the mouths of shallow rivers, and was therefore not adapted for service at sea, unless in fine weather. A much larger iron steamer — the Albatross, of 1,000 tons — has recently been built for the use of the fish-commission, and is now being fitted up expressly for deep-sea service, for which she will be in every respect well adapted, and will have the best equipment possible for such investigations at all depths. The examination of the bottom beyond the depth of about 700 fathoms has, therefore, been deferred until the completion of the Albatross.

In addition to the three trips made in 1880, seven trips were made by us in 1881 from Wood's Holl, and in 1882 five trips. During these fifteen trips, on each of which a single entire day was usually employed in dredging, we occupied about 113 stations. At nearly all these stations we used a large beam-trawl of improved construction (fig. 1). In a few instances we used a large rake-dredge (fig. 2). On every trip fine surface-nets, or towing-

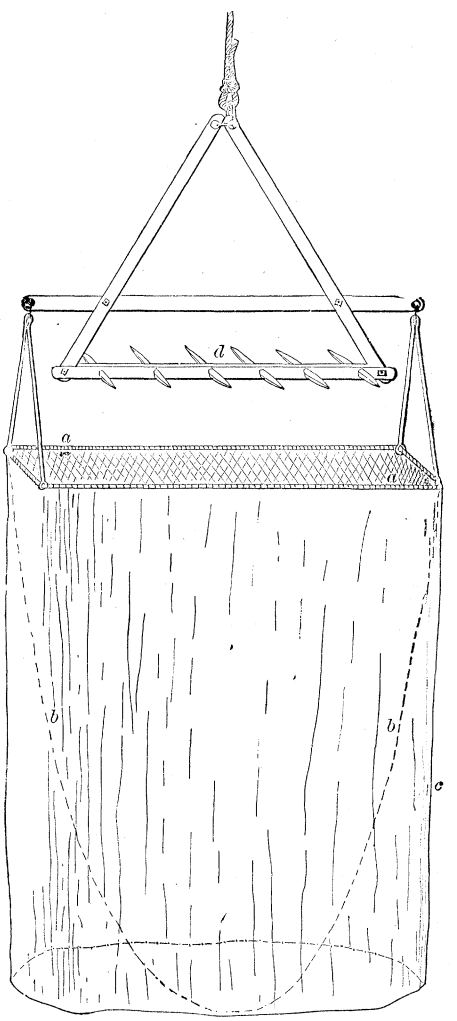


FIG. 2. — The rake-dredge rigged for use. The iron frame carrying the teeth, *d*, is about 3 feet wide; the teeth, about a foot long. The frame, *a*, carrying the net, *b*, is 4 feet long; *c* is a canvas bag to protect the net.

nets (fig. 3), were used to capture free-swimming animals, whenever the motion of the steamer was sufficiently slow to permit

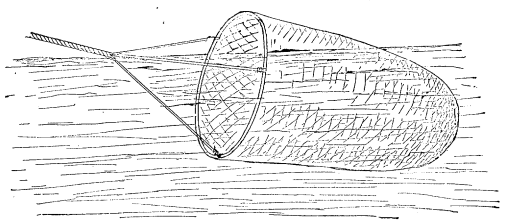


FIG. 3. — The towing-net, in the position that it takes while in use, half buried beneath the surface of the water. Those used by us are mostly 10 to 14 inches in diameter.

this mode of collecting. In these towing-nets, and in long-handled dip-nets, we secured a great variety of pelagic creatures, such as jelly-fishes, Salpa, Sagitta, various small Crustacea, and especially large numbers of Entomostraca.

Our dredgings in this region now cover a belt about 160 miles long, east and west, and about 10 to 25 miles wide. The most eastern stations are south-east of Cape Cod; the most western are south of Long Island. They are mostly between 80 and 110 miles from the coast-line of southern New England (see map, p. 444). The regular work of the party during the season, Capt. Tanner made a special trip to the Gulf Stream slope, off Chesapeake Bay, in 1880, and another off Delaware Bay in 1881. On both of these occasions valuable collections were made, and additional data in regard to the depth and temperature were obtained. He occupied seven stations, in 18 to 300 fathoms, in 1880; and eight stations, in 104 to 435 fathoms, in 1881. These dredgings show the direct southward continuation of the inshore cold belt, and the warm belt outside of it, as well as the cold deep-water belt, with but little change in the fauna of each.

2. Physical features of the region.

The total number of species of animals already obtained by us from deep water in this area is not less than 800. The number already identified or described, and entered on our lists of the fauna, is about 650. This number includes neither the Foraminifera nor the Entomostraca, which are numerous, and but few of the sponges. Of this list, less than one-half were known on our coast before 1880, and a large number were entirely unknown to science. Of fishes there are, perhaps, 70 species. Of the whole number, already determined, about 265 are Mollusca, including 14

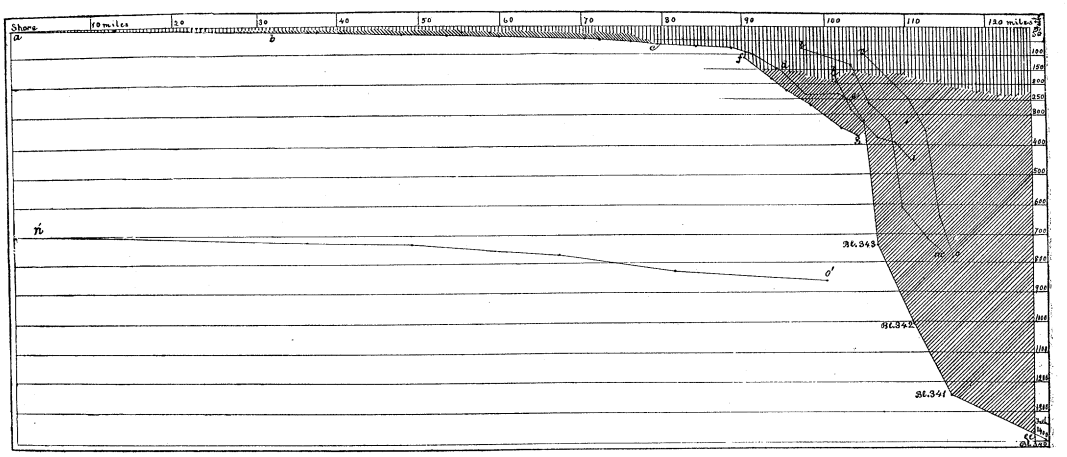


DIAGRAM 1. — To illustrate the relative slope or profile of the bottom, from the shore to the Gulf Stream slope, and across portions of the slope in several lines. Vertical to horizontal scale, 1: 360. The line n'–o' shows the actual slope along the line n – o. The vertical shading indicates the position of the comparatively warm water, both of the surface and of the Gulf Stream; oblique shading to the right indicates the cold water of the shallow plateau; oblique to the left, the cold water of the greater depths.

depths are mostly between 65 and 700 fathoms. Probably no other equally large part of the ocean basin, in similar depths, has been more fully examined than this. In addition to the Cephalopoda; 90 are Crustacea; 60, Echinodermata; 35, Anthozoa; and 65, Annelida.

The apparatus used on the Fish Hawk has been better in many respects than most other

vessels engaged in such work have had. Each year new improvements have been made. The 'trawl-wings,' first introduced by us in 1881, have been used with great success; for they have brought up numerous free-swimming animals from close to the bottom, which would not otherwise have been taken. The use of steel wire for sounding, and of wire rope for dredging, has enabled us to obtain a much greater number of dredgings and temperature observations than would have been possible under the old system of using rope, employed even on the Challenger. The use of steel-wire rope for dredging, first invented by Mr. A. Agassiz, and very successfully employed by him on the Blake, has proved to be an improvement of very great value in deep water. By its use there is an immense saving of time, and consequently a great increase in the value of the results. As an illustration of the rapidity with which dredging has been done on the Fish Hawk by using the wire rope reeled upon a large drum, I give here memoranda of the time required to make a very successful haul. In 640 fathoms, at station No. 1124, the large trawl was put over at 4.29 P.M.; it was on the bottom at 4.44, with 830 fathoms of rope out; commenced heaving in at 5.17; it was on deck at 5.44 P.M.; total time for the haul, 1 hour and 15 minutes. The net contained several barrels of specimens, including a great number and large variety of fishes, as well as of all classes of invertebrata, — probably more than 150 species altogether, many of them new.

At all the localities that we have examined, the temperature of the water, both at the bottom and surface, was taken, as well as that of the air. In many cases, series of temperatures at various depths were also taken. Many other physical observations have also been made and recorded. Lists of the animals from each haul have been made with care, and arranged in tables, so far as the species have been determined up to date.

South of New England the bottom slopes very gradually from the shore to near the 100-fathom line, which is situated from 80 to 100 miles from the mainland. This broad, shallow belt forms, therefore, a nearly level, submarine plateau, with a gentle slope seaward. Beyond the 100-fathom line the bottom descends rapidly to more than 1,200 fathoms into the great ocean-basin, thus forming a rapidly sloping bank, usually as steep as the slope of large mountains, and about as high as Mount Washington, New Hampshire. This is well shown by diagram 1, which illustrates the relative slope at several lines of dredging, and the *actual* slope $n'-o'$ along the line $n-o$. We call this the Gulf Stream slope, because it underlies the inner portion of the Gulf Stream all along our coast, from Cape Hatteras to Nova Scotia. In our explorations a change of position of less than 10 miles, transverse to the slope, sometimes made a difference of more than 3,500 feet in depth.

[*To be Continued.*]

THE INTERNATIONAL FISHERIES EXHIBITION.

IT is just thirty-two years, nearly the third part of a century, since international exhibitions were inaugurated. The 'Great exhibition' of 1851 marks an epoch in the history of England. It brought with it new aspirations for culture, and new methods of education in science pure and applied, in the arts aesthetic and industrial, arousing them to a new intellectual life. "The Great exhibition of 1851," remarks a popular novelist, a social philosopher as well, "did one great service for country people: it taught them how easy it is to get to London, and what a mine of wealth, especially for after-memory and purposes of conversation, exists in that big place." It gave them the great treasure-houses of South Kensington, and the smaller kindred museums in all parts of the United Kingdom.

The world at large has profited by the same experience, though perhaps to a less degree. Every nation, almost every great city, has had its 'world's fairs,' and, according to its capacity, has profited by their lessons. It is doubtful whether we shall ever see another universal exhibition so extensive as those of Philadelphia (1876), of Vienna (1873), and of Paris (1867). The ideal has become too lofty; and the exhibition of to-day, like the worker, must be devoted to a specialty. The fisheries exhibition, soon to open at South Kensington, is as nearly as possible upon the site of the exhibition of 1851, and covers precisely the same area of ground; namely, twenty-one acres. It would be instructive to estimate how large an extent of territory would be covered by an exhibition in which should be represented, with the minuteness of to-day, all the divisions of the classification of 1851, — a classification, which, for minuteness, comprehensiveness, and philosophical system, has not since been equalled. An entire English shire would hardly suffice.

Special exhibitions have probably entirely superseded those of general scope, and their number is yearly increasing. In one year, re-

cently, the government of Austria participated in fifteen. Amsterdam, Zurich, Lisbon, Hamburg, Vienna, Madras, and Tokio, among others, have exhibitions of varying scope now in progress, or soon to open.

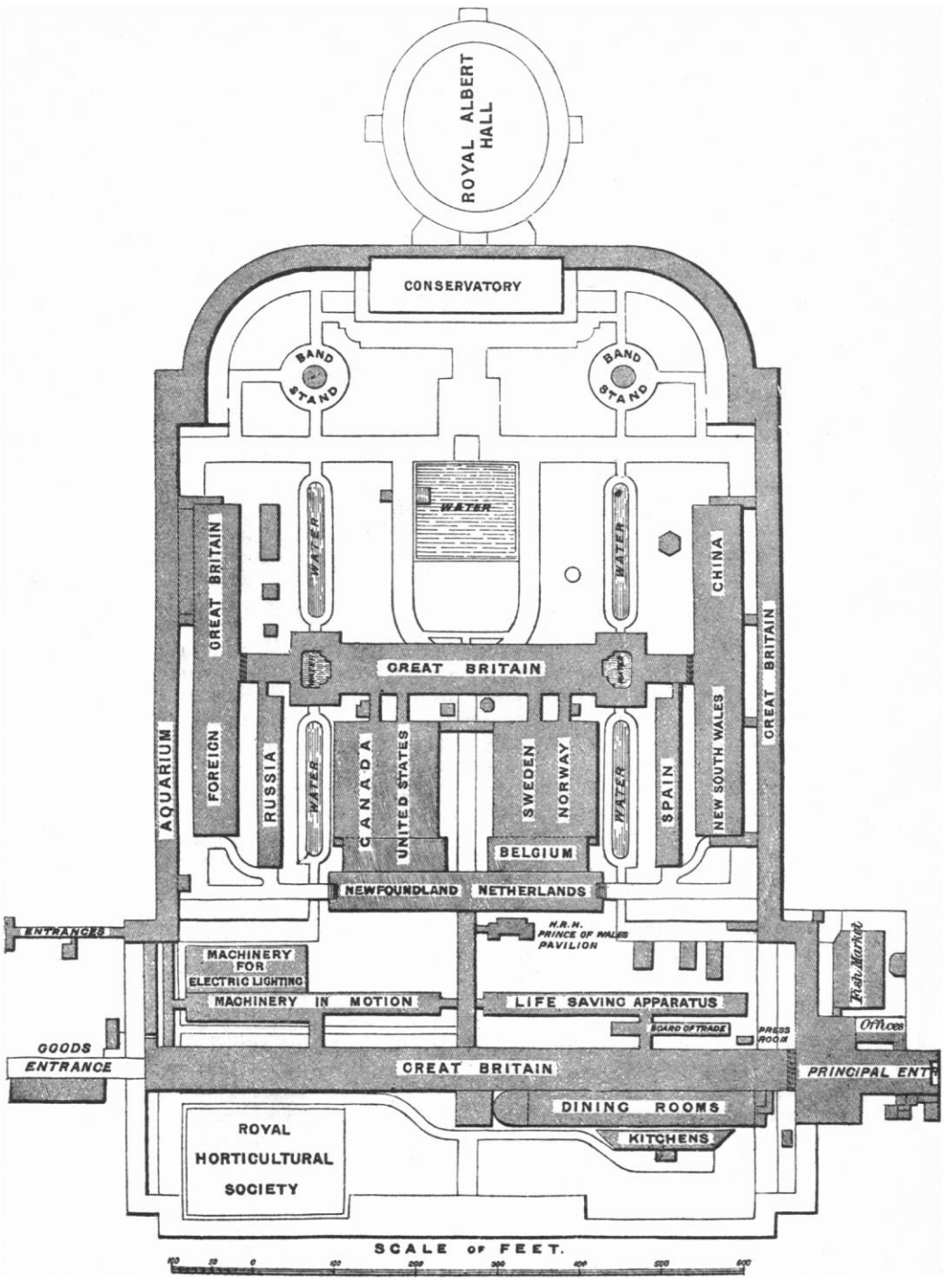
The fisheries exhibition is an institution at the success of which even the most sanguine seem to be astonished. No one has yet propounded a theory which explains satisfactorily the reason why these exhibitions succeed, yet succeed they do, perhaps more fully than special exhibitions of any other kind; and, moreover, they seem to enlist the interest of a larger number of scientific workers than do other exhibitions, though, of course, the electrical, geographical, and meteorological exhibitions are attractive in a higher degree to the students of those individual specialties.

The Berlin fisheries exhibition of 1880 was largely under the control of specialists in science. Among its most active supporters were men like Virchow, Peters, Magnus, Hilgendorf, Dohrn, Möbius, Von Siebold, Nitsche, Oscar Schmidt, H. A. Meyer, Wittmack, and Jäger, almost all of whom were on the board of direction; while, as commissioners and jurors, Italy sent Targioni-Tozzetti, Giglioli, Ricchiardi, Pavesi, Vinciguerra, and Cavanni, in short, all her marine zoölogists; Bohemia, Fritsch; Denmark, Lütken; Russia, De Solsky and Grimm; Norway, Raasch and Collet; and Sweden, Smitt, Thorel, and Malm. It is not difficult to understand why a statesman, diplomatist, and political economist like Professor Virchow should be willing to give up his days and nights for two months to committee and jury meetings, when it is remembered how much stress Germany places upon all which relates to the food-supply and the economy of all natural resources; but other interests must have influenced men like Von Siebold and Peters.

A similar array of names known to science appears in the prospectus of the London exhibition. Among the vice-presidents are the Duke of Argyll, Lord Walsingham, Sir John Lubbock, Professor Huxley, Dr. Gunther, and Mr. Spottiswoode, several of whom, together with Professor Flower, Mr. Robert H. Scott, Sir Philip Cunliffe Owen, and Mr. Saville Kent, are members of the general committee. It seems a little remarkable, however, to see the name of the president of the Royal society standing at the very tail of the list of vice-presidents, followed only by "The prime warden, wardens, and court of assistants, of the fishmongers company." At the other extreme is placed H. R. H. the Duke of Edinburgh. James Russell Lowell, Esq., is also a vice-president, his name standing between those of the Duke of Westminster and the Marquess of Salisbury.

Among the foreign commissioners are Prof. F. A. Smitt of Stockholm, R. Trybom of Lund, and Dr. Malm of Gothenburg, Professor De Solsky of St. Petersburg, Professor Hubrecht and Baron Von Hert of Utrecht, Professor Giglioli of Florence, Professor Nitsche of Tharandt, and Dr. M. Lindeman of Bremen. Surgeon-Gen. Francis Day is acting as commissioner for India.

An examination of the classification of the exhibition discloses the nature of the tie which binds together the varied interests represented in the lists of names which have been quoted. The ethnologist and the mechanician, as well as the fisherman, are concerned in the 'fishing-gear and the fishing-craft of all nations;' the meteorologist and the pharologist, as well as the philanthropist, in the 'life-saving apparatus of all kinds;' the physicist, as well as the navigator, in the "compasses, barometers, telescopes, lights, lamps, fog-horns, systems of signalling, electric lights, luminous paint and other equipments of fishing-vessels," and in "methods of communication from the shore to lightships and fishing-fleets by submarine cables, telephone, or other means of signalling;" while the geographer and geologist find something to interest them in the charts and relief-models of the ocean and its bottom. The chemist, the sanitarian and physiologist, as well as the merchant, transporter, and manufacturer, are touched by the section which illustrates the preparation, preservation, and utilization of fish, and the food, apparel, and dwellings of the fishermen. The jurist, the statesman, and the historian may study the "History and literature of fishing, fishery-laws, and fish-commerce." Biologists of every class must study classes IV. and V.; for the word 'fish' is broadly interpreted, and is held to signify any creature living in the waters: to wit, as enumerated, *a*, Algae, to be arranged under genera and species, with localities appended; *b*, sponges in their natural state; *c*, corals in their natural state, polyps, jelly-fish, etc.; *d*, entozoa and epizoa; *e*, mollusca of all kinds; *f*, star-fishes, sea-urchins, holothurians; *g*, worms used for bait, or noxious; leeches, etc.; *h*, perfect insects, and larvae of insects, which are destroyers of spawn, or serve as food for fish; *i*, crustacea of all kinds; *k*, fish of all kinds; *l*, reptiles, such as tortoises, turtles, terrapins, lizards, serpents, frogs, newts, etc.; *m*, aquatic and other birds hostile to fish or fishing; *n*,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NEW SOUTH WALES
BELGIUM
NEWFOUNDLAND
NETHERLANDS
ENTRANCES
H.R.H. PRINCE OF WALES PAVILION
MACHINERY FOR ELECTRIC LIGHTING
MACHINERY IN MOTION
LIFE SAVING APPARATUS
BOARD OF TRADE
PRESS ROOM
Offices
Fish Market
GOODS ENTRANCE
GREAT BRITAIN
PRINCIPAL ENTR
DINING ROOMS
KITCHENS
ROYAL HORTICULTURAL SOCIETY
SCALE OF FEET.

aquatic and amphibious mammalia (otters, seals, whales, etc.), and others detrimental to fish. As if this were not sufficiently catholic, division 40 is a trap to catch any interests not already retained. It is defined as follows, under the head 'scientific investigation:' physico-chemical investigation into those qualities of salt and fresh water which affect aquatic animals; investigation of the bottom of the sea and of lakes, shown by samples; aquatic plants in relation to fishing, etc.; researches into the aquatic fauna (animals of the several classes preserved in alcohol, or prepared, etc.); apparatus and implements used in such researches.

Ten of the twenty-three subjects announced for the essays are purely biological, and many of the others can be handled only by scientific investigators.

The fisheries exhibitions of to-day are therefore more than their names would seem to indicate. Perhaps they might more appropriately be called hydrological exhibitions. Their scope has increased as they have become more popular. The first, held at Amsterdam in 1861, was much less ambitious. Others followed at Bergen, Norway (1865), Arcachon, France (1866), Bologne (1866), The Hague (1867), Aarhuus, Denmark (1867), Vienna (1867), Gothenburg, Sweden (1867), Havre (1868), Naples (1871), Berlin, London (1878); and in Berlin, in 1880, the climax was apparently reached in a display, which, for extent and completeness, no one supposed would ever be surpassed. Great Britain has since had exhibitions at Edinburgh, Norwich, and Tynemouth; and attention of the whole nation is now concentrated upon the exhibition which is to be opened by the Queen on the 12th. It is generally admitted that it is the most important exhibition held here since the Great exhibition of 1851. Twenty-five nations and colonies are represented. In the catalogues and in the announcements the place of honor is given to the United States; and the officers do not hesitate to admit that the success of the affair was largely assured by the prompt and liberal action of our government, — action which may be regarded as, in part, an acknowledgment of the very generous manner in which England participated in our own exhibition in Philadelphia in 1876.

South Kensington, May 1. G. Brown Goode.

THE WEDGE-PHOTOMETER.

This instrument has been attracting considerable attention during the last year, and has been especially studied by Professor Pritchard of Oxford and Professor Pickering of Harvard, to each of whom we owe a form of the instrument. It depends for its efficiency on the accurate observation of the time of extinction of the light of a star; and as it is evident that the various sources of error in photometric work — moonlight, the state of the atmosphere, the condition of the eyes of the observer, the position of observation, whether that of comfort or constraint — would affect a faint point of light near extinguishment more than they would the brighter lights used in other photometric methods, any contribution to the question of the accuracy to be expected from the wedge-photometer may be of interest.

The instrument employed by me is of the form suggested by Professor Pickering. It was made by Mr. J. Grunow of New York, and seems to be very good work. It consists of a wedge of London smoke glass an inch square, and about a twentieth of an inch thick at its blunt edge, a large low-power positive eye-piece, and a special adapter, and is a very convenient photometer to use. The color of the wedge is deep enough to give one magnitude of the ordinary scale of the brighter stars for each five seconds in the time of extinction at the equator.

For the study of the accuracy of observation with this instrument, I selected the Durchmusterung star 22°.2164, of which Argelander puts the magnitude at 5.3. In observation I took alternate observations on this, and the star to be compared with it, until I had five for each star, which I called a set of observations. By this method I made the conditions of observation as nearly as possible the same for the two stars, and thus the difference in their time of extinction nearly free from error.

My comparisons were made chiefly with the star Durchmusterung 22°.2163 of the catalogued magnitude 8.8. Between April 2 and April 29 I made twenty-eight sets of observations on the two stars. The difference in their time of extinction varied from 19.1 seconds to 21.6 seconds; approximating, however, pretty closely to the mean 20.6 seconds, of which the probable error was ± 0.09 in seconds, equivalent to ± 0.015 in magnitudes. The mean error of a single set of observations is ± 0.68 seconds, or ± 0.12 magnitudes. A series of four sets of comparisons of star 21°.2156 gave a mean error of ± 0.68, and a probable error of ± 0.23; and a series of five sets with 21°.2156 gave ± 0.83 and ± 0.24, in both cases in seconds.

These observations were made under various conditions with no more than usual care, and probably represent fairly the accuracy easily attainable. With further practice the errors could probably be reduced. In general, my observations seem to show that single sets of observations by this wedge-photometer are trustworthy to one or two tenths of a magnitude. If so, there is much that can be done by it; and as the simplicity, convenience, and inexpensiveness of the instrument are such as to recommend it, similar instruments could properly be a part of the outfit of every observatory.

The above errors are correct on the supposition that none of the stars examined were variable; and I found no evidence that they were. In the case of another star, however, either the star was variable, or the errors made were much larger than in the other cases, though the observations were made at about the same time. The star in question is 22°.2162. The average difference between it and 22°.2164 is 25.1 seconds for twenty-three sets; but the individual sets range from 28.0 seconds on the 15th, at 13h. sidereal time, to 22.3 seconds on the 19th, at 12h. The mean error of a single set is 1.34 seconds, and the probable error of the mean, ±0.58 second. As I believed I could trace with the eye a change in the brightness of the star, I think we have in this case a variable, with a range of about one magnitude, rather than observations much less accurate than others taken at the same time. M. W. HARRINGTON.

NOTES UPON THE FOETAL MEMBRANES OF THE OPOSSUM AND OTHER MARSUPIALS.

I RECENTLY had the good fortune to receive from Mr. Robert Speir of South Orange, N.J., a female opossum which had been captured within a few days after impregnation. I was thus enabled to make very satisfactory observations upon the foetal membranes, about which there has been so much uncertainty for many years. These embryos were in an early stage of growth, and, although they plainly showed very novel and unexpected features, no positive conclusions could be reached as to their later development. At this point a correspondence with Professor Wilder of Cornell resulted in his very generously sending me a quantity of marsupial material which he had procured from Australia. Among this material was a nearly perfect foetus in a late stage of development. An examination of this fully confirmed the observations upon the opossum embryos, and showed the relations of the foetal membranes at a later period. More recently Professor Chapman, of the Jefferson medical college, has kindly allowed a thorough examination of a valuable kangaroo foetus in his possession, which he has described in the proceedings of the Philadelphia academy for 1881. This foetus was in a stage intermediate between that represented by the opossum embryos and that of the foetus sent me by Professor Wilder: it showed the same features as the other specimens in an intermediate stage of growth.

In all these specimens the membranes are arranged very much as those of a kangaroo foetus which Professor Owen described in 1833. The peculiarity of the foetal membranes of this animal, which has ever since been used as a basis of classification distinguishing the marsupials from the higher mammals, is, that the allantois never attains a very great size, so that nothing like an allantoic placenta is formed; and the function of absorbing the maternal nutrition, during the short period of intra-uterine life, has always been considered to have devolved entirely upon the yolk-sac. Professor Owen, in the older of the specimens which he examined, found that the membranes were arranged as follows:[1] the foetus was enveloped in a large subzonal membrane, with folds fitting into uterine furrows, but *not adhering to the uterus, and without villi;* the embryo was enveloped in an amnion reflected over the stalk of the yolk-sac. This sac was large and vascular, and was connected with the foetal vascular system by a vitelline artery and two veins. There was a small allantois supplied by two allantoic arteries and one vein: it was quite free, and not attached to the subzonal membrane. The area of attachment of the yolk-sac to the inner surface of the subzonal membrane formed a disk bounded by the sinus terminalis, or circular venous trunk. When spread out, therefore, the yolk-sac formed the figure of a cone, of which the apex was the umbilical cord, and the base the sinus terminalis.

These valuable observations were confirmed by Professor Chapman in his paper referred to above. They are accurate so far as they go; but they leave us in doubt as to the real relations which exist between the foetus and the mother, inasmuch as they give no clew to the manner in which the embryo is nourished during its intra-uterine life, — a period of about

[1] This description is largely taken from Balfour's Comparative embryology, vol. ii. p. 199.

seventeen days in the opossum,[1] and thirty-eight days in the kangaroo.[2] My fortunate discovery of the early opossum embryos, and the subsequent examination of the two other marsupials, seem to throw a great deal of light upon this question, if they do not actually solve it. The principal facts which have been brought out may be briefly stated.

1. In the opossum the yolk-sac spreads out over about one-third of the inner area of the subzonal membranes, and forms a highly vascular disk, the *false chorion* of the placental mammals. This disk is ventral to the embryo; and among the numerous embryos which were examined *in situ*, these disks were found to be *invariably placed in a long uterine furrow*, while the remainder of the enveloping membrane floated free in the cavity of the uterus. The use of the word 'attachment' would be misleading in this connection, as a slight touch with the needle was sufficient to remove the embryos from their position. The outer surface of the subzonal membrane, all over the area to which the yolk-sac was adherent, was found to be covered with minute villi, which were just visible to the naked eye. These villi are simple upgrowths of the subzonal epithelium, shaped like little hillocks, and confined to this area. At this early stage they are hollow.

2. In Professor Wilder's specimen,[3] villi were found to be scattered over the same area of subzonal membrane; but in this case their development had proceeded much farther, and, although they were extremely minute, each was found to be provided with a solid papilla, which arose from the epithelium of the yolk-sac. A closer examination showed that the cap of subzonal epithelium was composed of flattened cells, and that the papilla was provided with capillary branches derived from the vessels of the yolk-sac. These villi conform, therefore, to what Professor Turner has described as the simplest type of allantoic villi, the nearest approach to which, among the placental mammals, is found in the pig.

3. In the kangaroo foetus the villi could be seen without a lens. They were, however, so minute, that it is not at all surprising that they have been overlooked hitherto. They were spread over the highly vascular portion of the yolk-sac, which is loosely attached to the subzonal membrane. A close examination into their structure has not yet been made.

4. The allantois in the opossum embryos was found in various stages of growth, but in none was it attached to the subzonal membrane. In Professor Wilder's specimen it was highly vascular, and appeared to show a *disk-like area of attachment to the subzonal membrane*. This area showed no traces of villi. The subzonal epithelium consisted of flattened cells. In the kangaroo it was an extremely small vascular sac.

5. Owing to an accident, one horn of the uterus in which the embryos were preserved *in situ* was destroyed, so that no satisfactory study of the uterine wall could be made.

The presence of villi over that portion of the subzonal membrane which is in contact with the uterine wall renders it highly probable from analogy that minute crypts are present upon the latter. At all events, we now have data sufficient to establish the following facts: that the so-called *false chorion* of some of the lower orders of placental mammals, formed by the spreading of the yolk-sac over the inner surface of the subzonal membrane, in the marsupials functions as a *true chorion*, developing simple villi, by which the maternal and foetal blood-vessels establish a feeble interchange: in other words, the functions of the allantois in the placental mammals are, in a rudimentary way, performed by the yolk-sac in the marsupials. Finally, some genera of the marsupials probably show the attachment of the allantois to the subzonal membrane, which is the first step towards the establishment of an allantoic placenta.

These facts naturally give rise to a number of interesting questions, which will be discussed in a paper to be published in the *Quarterly journal of microscopical science* for July.

I wish to express my indebtedness to Professors Wilder and Chapman, without whose aid these observations would have been very incomplete.

HENRY F. OSBORN.

Morphological laboratory,
Princeton, May 11, 1883.

[1] See Bachman, Proc. acad. nat. sciences Philad., 1848, 44.
[2] See Owen, Comp. anat. and phys. of the vertebrates, iii. §400.
[3] The genus cannot be ascertained, owing to a misplaced label. The foetus undoubtedly belonged to one of the smaller Australian genera.

RAINFALL AT PANAMA.

IN the *Comptes rendus* for Feb. 26, M. de Lesseps publishes some interesting observations of rainfall for four years (1879–82) at the Isthmus of Panama. The accompanying table gives these observations, together with like observations at stations along the Pacific coast, which are added for the purpose of comparison.

M. de Lesseps remarks that the rainy season lasts about six months, from May to November, with an interruption at the end of June and beginning of July. He assigns as a cause for these peculiarities the advance of the (overhanging) sheet of rising air which

Table of rainfall at Panama and other stations.

	Panama, lat. 9° N., long. 80° W.					San José, lat. 10° N., long. 84° W.	Mazatlan, lat. 23° N., long. 107° W.	San Diego, lat. 33° N., long. 117° W.	S. Francisco, lat. 38° N., long. 122° W.	Portland, lat. 46° N., long. 123° W.
	1879.	1880.	1881.	1882.	Mean, 4 years.	Mean, 2 yrs.	Mean, 2 yrs.	Mean, 7 yrs.	Mean, 7 yrs.	Mean, 7 yrs.
	//	//	//	//	//	//	//	//	//	//
January .	0.04	1.89	0.16	0.00	0.52	0.22	1.74	1.72	6.61	4.98
February .	2.52	.12	.16	.12	.73	.00	.00	1.55	4.34	8.78
March . .	5 71	.16	.35	.00	1.56	1.00	.00	1.21	3.45	7.87
April . .	5.55	1.61	3.23	.98	2.84	4.20	.00	.95	2.38	2.91
May . . .	10.28	4.45	10.35	5.24	7.58	7.44	.00	.19	.64	2.90
June . . .	6.46	5.00	13.78	6.18	7.86	6.23	2.12	.06	.26	1.81
July . . .	7.91	9.88	7.20	5.35	7.58	10.30	10.16	.03	.01	.74
August . .	7.24	11 46	4.49	4.06	6.81	5.16	9.14	.08	.00	.91
September.	9.02	7.91	8.94	4.06	7.48	9.14	15.96	.07	.14	1.99
October .	9.80	11.81	9 69	6.69	9.50	10.02	3.26	.46	1.29	4.51
November .	19.21	6.46	9.72	10.91	11.58	2.87	.80	.90	3.08	8.83
December .	.98	5.51	2.48	2.01	2.74	.88	3.06	2.43	3.50	7.46
Year . .	84.72	66.26	70.55	45.60	66.78	57.46	46.24	9.65	25.70	53.69

accompanies the curve of maximum daily temperature due to the annual oscillatory movement of the thermal equator. The movement of this curve is closely connected with the annual movement of the sun across the geographical equator. The sun passes the zenith of the isthmus at mid-day twice in the year, on April 13 and Aug. 29. The sheet covers the isthmus from the beginning of May to the end of June, and from the end of July to the beginning of December. These two intervals occurring between the first of May and the first of December constitute the rainy seasons. The first is generally interrupted by the short 'summer of St. John.' During the remainder of the year is the dry season. At this time the sheet is entirely to the south of the isthmus, while during the 'summer of St. John' it is entirely to the north.

On the north side of this sheet the trade-winds of the northern hemisphere prevail, which, at the isthmus, have in general a direction from the north-east. On the south side the trades of the southern hemisphere prevail, which have a direction from the south. In the interior of the sheet, at the earth's surface, the wind is feeble and uncertain. This, then, for the isthmus, is the period of calms, the time of gentle breezes; now from the land, now from the sea, according to the hour of the day.

Percentage of precipitation in each month.

	Panama.	San José.	Mazatlan.	San Diego.	San Fran'co.	Portland.
January. .	1	0	4	18	26	9
February .	1	0	0	16	17	16
March . .	2	2	0	12	13	15
April. . .	4	7	0	10	9	6
May . . .	11	13	0	2	2	5
June . . .	13	11	5	1	1	3
July . . .	12	18	22	0	0	1
August . .	10	9	20	1	0	2
September .	11	16	34	1	1	4
October . .	14	17	7	5	5	8
November .	17	5	2	9	12	17
December .	4	2	6	25	14	14
Total . .	100	100	100	100	100	100

M. de Lesseps further remarks, that one can see, that, in the time during which the (overhanging) sheet of ascending air is over the isthmus, the season of rain prevails, because the trade-winds, blowing along the ocean's surface, accumulate in this sheet a mass of vapor, which rises up, comes to the higher regions of the atmosphere into lower and lower temperatures, and is condensed; producing, thus, a vault of perpetual cloud, which generally surrounds the earth in a dark ring, — called, by the French sailors, '*pol au noir;*' by the Americans and English, 'cloud ring,' — and continually precipitates during the rainy season the showers of the tropical regions.

The waters of the gulf-stream which come from the equator are charged with a great quantity of vapor; and this is condensed and precipitated by the Cordilleras. This accounts for the abundant rains of the Atlantic watershed. This cause does not exist on the Pacific watershed. The general current along the coast of the isthmus is just the reverse of that in the sea of the Antilles. On the contrary, the tide comes from the north; and in consequence these waters are cooler, and furnish less vapor to the air flowing along the surface. This explains why it rains more at Colon than at Panama, and why, in proportion as one removes from the Atlantic coast, the rain diminishes. So upon the island of Naos, situated in the Bay of Panama; and, where the canal company has established a meteorological station, the rain gathered is less than at Panama.

The existence of winter and summer rains in belts approximately parallel to the equator has been long recognized. A glance at the table above will show that the rains all along the Pacific coast are markedly periodic, and occur later in the year as we go north; and the heavier rainfall occurs at the time the sun is the farthest south of the equator.

H. A. HAZEN.

THE COPPER-BEARING SERIES OF LAKE SUPERIOR.

IT may not be unprofitable, at this presumably the closing stage of the present discussion of the Keweenawan series, to state summarily the main grounds on which its pre-Potsdam age is maintained. It is obvious that such a statement can but imperfectly indicate the nature of the evidence relied upon; for the significant data are derived from numerous localities, and from diverse phenomena which cannot be adequately, and at the same time briefly, described. The formation involves an area of upwards of forty thousand square miles; and only a wide survey of it, a critical elaboration of trustworthy observations, and a judicial treatment of the evidence, can command complete deference, and that is a thing of the future. No

one has seen the formation in its entirety; and only one investigator has approached to a general familiarity with it by personal study, and his more comprehensive results are not yet before the public. I have even hesitated on this account to offer this summary, having myself visited only seven of the significant districts outside of Wisconsin, with the investigations within which I have, of course, been intimately familiar, as also with the results of Professor Irving's more extended studies, which are herein somewhat drawn upon.

Brevity requires the omission of citations and authorities in the main.

The general stratigraphical facts which are not open to reasonable question are these: 1. Around the edges of the great depression occupied by Lake Superior lies an immense series of interleaved igneous and detrital beds, dipping inward toward a synclinal axis, lying mainly beneath the lake, but stretching landward across north-western Wisconsin; 2. Both within and without this basin are horizontal series of sandstones, each of which is traceable into contact with the dipping series at a few points, and into approximate junction at several others. The horizontal sandstone on the outside contains primordial fossils, and has long been known as Potsdam. The horizontal sandstones within the trough, unfortunately, have not yet yielded fossils of any positive character. Some of these are so situated that they might be supposed to be portions of the synclinal fold, but the greater part are not so placed as to admit of this interpretation.

Now, those who advocate the distinctness of the Keweenaw series maintain that the great tilted group of interbedded igneous and detrital rocks which constitute the copper-bearing formation belongs to an entirely different age from the horizontal sandstones without, and from most, but not all, those within. They offer, among other considerations, the following classes of evidence in support of their view: —

1. First and weakest, *the general stratigraphical relations above indicated.* — These afford at least a presumption of distinctness. This admits of easy verbal objection, and to those personally unfamiliar with the *tout ensemble* of the problem and its data, and with the methods Nature habitually pursues in distinction from those she might be imagined to pursue, can have but little force; but experienced stratigraphists will appreciate the fact, that great differences in the attitudes of closely associated strata, especially if otherwise differentiated, are usually indicative of differences in age, and that definite evidence of unity is required to justify the somewhat violent dynamics necessary to otherwise explain these diverse attitudes. This is especially true when the surrounding region is altogether devoid of evidence of disturbance during the supposed period of disruption. Not only in the immediate vicinity, but throughout the interior, there is an absence of evidence of more than the gentlest oscillations in the recognized primordial strata; while the Keweenaw series suffered a depression of more miles than it would seem judicious to estimate here, and embraces one of the most stupendous series of eruptions known to early geological history. Upon this argument, being a general one, we do not much insist. It gains force, however, in connection with the following points, and gives especial significance to the next.

2. *Differences in thickness.* — The recognized Potsdam strata in the adjacent region have been penetrated at numerous points by artesian wells, and are only rarely found to reach a thousand feet in depth. On the other hand, the thickness of the Keweenaw series is so enormous as to have led to a studied watchfulness for possible sources of error of estimate. Unless faults be assumed where there is no proof of them, the maximum thickness must be upwards of forty thousand feet, of which about fifteen thousand feet are detrital. Without insisting in a controverted matter, that this estimate may not be too high, owing to undiscovered faults, it remains that an enormous difference is absolutely demonstrable. Now, this great difference means something in the mere matter of accumulation, but great stress is not laid upon this. Plausible, but really inapplicable, answers readily suggest themselves. If, however, it is insisted that the igneous eruptions furnished exceptional conditions for rapid accumulation, it will be freely granted, and even urged: but the great mass of the detrital beds were formed after the eruptions had ceased; and, besides, the fossiliferous Potsdam strata lie against the same rocks in the St. Croix region, and, if contemporaneous, should have been likewise favored in accumulation.

But whatever this incongruity of thickness signifies in the question of deposition, it is at least important in the interpretation of the discordant attitudes of the strata, and the adjudication of approximately observed, but not actually visible, unconformities. We hold that to be a violent structural hypothesis which assumes that portions of the same unmetamorphosed series are tilted at high angles, while, within a distance much less than the thickness of the formation, other portions lie undisturbed. That this extraordinary phenomenon should be several times repeated, in a region not otherwise characterized by more than broad open folds, seems to us incredible.

3. *Differences in constitution.* — The sandstones of the Keweenaw series are largely composed of grains of various *silicates* derived from igneous rocks; while the Potsdam, within as well as without the basin, is mainly *quartzose*, as shown by the investigations of Irving and Sweet. The former are manifestly derived, as maintained by these writers in common with others on both sides of the question, immediately from the igneous series, with relatively little wear or assortment. The latter are thought to have had wider sources, and to have been subjected to more erosion and winnowing; for even where in the vicinity of the igneous series they are still notably quartzose.

4. *Unconformity.* — While every unconformity has a significance, only those are urged in this relationship which seem to us to testify directly to the fact of a tilting of the great copper-bearing beds before the Potsdam sands were laid down upon and against their upturned edges. The cases of unconformity may be grouped in three classes: *a*, those actually observed; *b*, those in which the contact, though observed, is complicated with disruption; and, *c*, those in which the immediate junction is concealed, and the evidence is only approximate.

a. Of the first class are those of the St. Croix district, substantiated by the independent observations of Sweet in 1875, Strong in 1876 and 1877, Winchell at one or more dates unknown to me, and myself in 1876, 1879, and 1880. There are also here several cases of approximately visible junctions beside those actually seen. To us, the facts — which manifestly cannot be properly described here, but which are in a measure set forth in the Wisconsin publications — teach explicitly that the copper-bearing beds were not only formed, but uplifted and extensively worn into hills and valleys, before the Potsdam sands were laid down against and upon them. The full force of the evidence presented by this region can only be felt when a just appreciation of the facts is acquired,

and judicially considered in connection with the great mass of stratigraphical evidence with which it links itself, and of which it furnishes at once the key and clearest exponent.

From this decisive locality, there stretches away north-easterly, to Keweenaw Point, a belt of outcrops constantly maintaining the typical character, *bedding*, and *dip* of the Keweenaw series. Mr. Strong mapped no less than fifty-five exposed areas within the county in which occur the unconformities on the St. Croix (*Geol. of Wisc.*, iii.; *Atlas*, sheet xix.); and no concealed interval of so much as four miles occurs along the belt within thirty miles of the decisive locality. Throughout the whole broad belt to Keweenaw Point, occupying several thousand square miles, all the outcrops, numbered by hundreds, are of the Keweenawan class, and there are *none of any other kind*. This we conceive to be decisive evidence, notwithstanding some concealment from drift.

b. To the second class belong the unconformities of Douglas County, in the extreme north-western corner of Wisconsin, and those of the Keweenaw range of Michigan. In the former region, in a distance of twenty-five miles, there are four excellent sections across the junction-line. These have been described in detail, and illustrated by Sweet. On the one side, the Keweenawan beds dip from 35° to 50° southward, terminating northward in upturned, worn edges. Approaching these from the opposite direction are horizontal beds, which, at a distance from the contact, are simple sandstones, but, near the junction, become conglomeritic from material manifestly derived from the copper-bearing series. The beds are locally broken and bent upwards near the junction; but this, in our judgment, does not vitiate the evidence of unconformity at the time of deposition. We maintain that these sections afford strong evidence that the Keweenaw rocks were upturned before the flat-lying beds abutting against them were formed.

Upon the discussion of the controverted contact-line along the base of the great escarpment of Keweenaw Point, I will not here enter, partly because it might be useless without elaborate discussion, and partly because I could scarcely fail to trench upon data that belong to another. The whole region in controversy has recently been re-examined, and sketches carefully prepared, intended to show the exact facts exposed to observation, stripped of the bias of interpretation. Pending their appearance, I need only call attention to the fault-line long since claimed by Foster and Whitney to exist here, — a view in which several subsequent students of the region acquiesce, among them Irving and myself, with qualifications. Now, while the existence of this fault may be maintained consistently with the view that the flat-lying sandstones on the east are the equivalents of the uppermost beds of the tilted series on the west, and also with the view that the eastern sandstones were deposited unconformably against the cliff formed by the upturned beds, the faulting in this case being held to have previously taken place, it is altogether inconsistent with the view that the eastern sandstones pass continuously under the cliff.

c. Besides the above regions, which present more than a dozen separate localities of actual or approximate contact, several other districts afford strong evidence of unconformity, though they do not rise to actual, at least to ocular, demonstration. The more important are found on the upper St. Croix River, on the Snake and Kettle Rivers in Minnesota, and in the vicinity of Lake Agogebic, Michigan. These localities present horizontal quartzose sandstones, regarded as Potsdam, lying near upturned igneous and detrital silicate rocks, referred, on the basis of irrefragable evidence, to the Keweenawan series. The relations of these are so close, that all recent investigators who have examined them regard them as instances of unconformity between diverse formations, and find no other explanation consonant with the general geology of the region. It was my purpose to present the more significant facts relating to these little-known districts, upon two of which I have made unpublished observations; but space forbids. Let it be observed, however, that in all cases the upturned beds are distinctly Keweenawan in type, and are referred to that series on stratigraphical evidence, that, apart from controversy, would be accepted as conclusive, while all the horizontal beds, which are exhibited at eight separate localities, are quartzose, and definitely of the type referred to the Potsdam. We hold these to be facts of much significance as parts of the chain of evidence. The wide range of territory represented by these several cases of unconformity adds to their force as evidence of the distinctness of the formations.

5. *The inherent consistency of the view.* — The harmony of the foregoing evidences, drawn from diverse sources and from widely separated localities, and the mutual confirmation they lend each other, as well as their accordance with the entire phenomena of the region, are inherent arguments for the correctness of the whole.

6. *The dynamic simplicity of the view.* — No important orographic movements, beyond those that must be independently assumed to explain the attitude of the Huronian strata of the region, and such faults as there is independent evidence of, are invoked. On the other hand, an extraordinary amount of local faulting and disturbance seems necessary to the alternative hypotheses, and this notwithstanding the unmetamorphosed condition of the beds.

7. *The discovery by the United States geologists of a like series in the Grand Cañon of the Colorado.* — This, while not a direct argument, has an important collateral bearing on the question. By reference to p. 183 of No. 6 of this journal, it will be seen that a series remarkably similar to the Keweenawan in its essential characters occupies the same general position and attitude, lying in inclined, unmetamorphosed beds, unconformably below the upper Cambrian, and also resting unconformably upon the crystalline archaean series. The observations of Bell show a somewhat similar group bordering Hudson's Bay; but too little is yet known of it to indicate its true horizon. The ultimate acceptance of the Keweenawan group as the representative of an important period in geological history, will, of course, largely depend on the discovery of similar formations elsewhere, or the persistent failure to otherwise fill the gap between the Cambrian and Huronian.

T. C. CHAMBERLIN.

Washington, D.C., May 5, 1883.

LIQUEFACTION, VAPORIZATION, AND THE KINETIC THEORY OF SOLIDS AND LIQUIDS.[1]

THIS paper discusses at length the two kinds of vibratory motion which the molecule of a solid body may have, rotary and translatory. It is demonstrated that the mean kinetic energy of such an oscillatory

[1] Abstract of a paper presented by H. T. EDDY, Ph.D., University of Cincinnati, to the Section of physics and chemistry of the Ohio mech. inst., April 26.

motion as is possible for a molecule of a solid reaches a maximum value which can only decrease, whether the amplitude of the oscillation be increased or diminished, and that the only way in which it is possible to increase the mean kinetic energy of this kind of motion is to impart sufficient additional energy to change the motion into one of complete rotation. By such a process, greater freedom of motion is given to the molecules, and a large amount of energy becomes potential. This is regarded as explaining the phenomenon of liquefaction.

It is shown by an extended mathematical discussion of the cohesive forces and resistance to compression, by which molecules hold each other at mean fixed distances, that the mean kinetic energy of the vibration of molecules about their mean positions also has a maximum value which can only be increased by removing them to such mutual distances that the cohesive forces no longer act. In this process a large amount of energy also becomes potential. This is regarded as the rationale of the phenomenon of vaporization.

It is further shown, that, on this theory, it might very readily occur that the specific heat of a liquid should at first decrease, and then increase, as Rowland has proved is the case with water, but that the specific heat could not at last decrease.

The cause of the relatively large specific heat of most liquids is treated. It is shown that the distribution of rotary velocities in free rotation, such as the molecules of a liquid are supposed on this theory to have, is such that the atoms of some small per cent of the molecules in any given mass must be torn asunder. What per cent of the liquid may be thus dissociated will depend upon the temperature and constitution of the liquid; it being smaller for the simpler liquids, and increasing with the temperature. Electrolysis is an evidence of this action. Such dissociation sufficiently accounts for the generally high specific heats of liquids.

There is a general qualitative accordance of the theory with observed specific heats. A further confirmation of the theory is found in the clear explanation it affords of the existence of a critical temperature, above which a vapor is uncondensable by pressure alone; for, when the mean kinetic energy of all the molecules of a liquid acquires a value greater than the maximum possible in a liquid state, the liquid is not only vaporized, but necessarily becomes an uncondensable gas, and remains so.

GERMS AND EPIDEMICS.[1]

AFTER a brief historical sketch showing the idea that certain diseases, and especially marsh-fevers and the plague, are caused by the entrance of minute living organisms into the body, to be a very old one, but one which, until within a few years, has had no experimental proof, some definitions were given of the terms now used in discussion of this subject; and the word 'microdeme,' meaning 'little living thing,' was proposed as a general designation for the minute living particles found in almost all air or water. The microdemes include the *Microphytes*, or minute vegetable organisms, and the *Microzoa*, — the microzomes, the bacteria, microbia, micrococci, etc. There is at present no evidence that any microdemes are derived from any source other than other living organisms, nor that the special microphytes which cause the various processes known as fermentations or putrefactions ever develop into the higher forms of fungi; although this is still an unsettled question, and there is some reason to think that some of the higher fungi may act as ferments.

The prevailing opinion at present is, that there are many different kinds of microphytes, each having special powers, and that each can only propagate its own kind within a certain limited time.

But it is also probable, that by changes in nutriment, temperature, etc., changes in their habits and powers may be produced through natural selection. These changes are so considerable as to cause them to appear to be new species. The germ theory is, that certain diseases are due to the presence and propagation in the system of minute organisms which have no part in its natural economy. The word 'germ,' however, is often erroneously applied to independent organisms which originate outside of the body itself, such as the particles in vaccine lymph which are not microphytes, and can hardly be called independent organisms.

The diseases caused by large and comparatively well-known organisms are called parasitic. Such are some varieties of skin-disease; as ring-worm, or the so-called live spots, the fungus foot of India, and the disease of the ear due to the growth of a peculiar Aspergillus. A new disease of this kind is the so-called actinomycosis, due to a fungus which forms tumors near the angle of the jaw, and which causes death when it becomes generalized.

An account was then given of the organisms found in splenic-fever, relapsing-fever, chicken-cholera, leprosy, etc., and the method of Pasteur for the so-called attenuation of virus was described. This method appears to depend largely on the exposure of the broods of micro-organisms to the influence of oxygen; and recently MM. Nocard and Mollereau have announced that the same can be effected much more rapidly by the use of oxygenated water. The question as to whether Pasteur's inoculation with artificially modified virus will afford permanent protection is still unsettled, for sufficient time has not elapsed to decide it; but there is reason to hope that it will be found to be of great practical benefit.

The effects of microdemes in producing pyaemia and puerperal-fever are well described, and attributed to a poison secreted by them, of the nature of the so-called ptomaines, rather than to their mere mechanical presence. This knowledge is practically applied in what is called antiseptic surgery; and the surgeon now undertakes, without hesitation, operations which, twenty years ago, would have been deemed quite unjustifiable; for he knows, that by insuring that neither through the air nor the water, the sponges nor the instruments, nor in any other way, a single microdeme which has not had its powers of growth and reproduction totally destroyed shall gain admission to the wound, he need have no fear of blood-poisoning.

As regards diphtheria, it is probable that it is due to a common micro-organism, which, under circumstances not yet understood, becomes virulent, as the micro-organisms of common sweet-hay infusion may be transformed into those which cause malignant pustule.

The connection of consumption with a microphyte is still doubtful, though not improbable; and the same may be said with regard to malaria.

A sketch was then given of some of the characteristic phenomena attending the great epidemics. For some, the germ theory appears to afford the best explanation; for others, such as influenza or cerebro-spinal fever, this theory is quite inadequate.

Special attention was called to the many points in

[1] Abstract of a lecture by Dr. J. S. BILLINGS, given in the Saturday course at the U. S. national museum, Washington, Feb. 17.

which our knowledge of these subjects is still fragmentary and imperfect, — points which are to be settled by direct experiment. Such experimental researches are of the highest value; and it is much to be regretted, that while the governments of England, France, and Germany, are employing their leading scientific men in such work, Congress has deliberately stopped a most promising series of investigation of this kind, and has resolved to confine its efforts to paying bills after an epidemic has made its appearance.

LETTERS TO THE EDITOR.

*** Correspondents are requested to be as brief as possible. The writer's name is in all cases required as proof of good faith.*

Use of the moxa in Japan.

As I rode behind the naked-backed jinriksha coolies, I noticed along each side of the spine, from the head to the hips, white, irregular scars, about the size of a dime, indicating, as I supposed, some skin-disease, to which they are very subject from their diet and exposure when young. These were the marks left by the *moxa*, a household remedy, probably invented in Japan, — a painful and powerful agent, well known in modern surgery. It is made of the pith of a reed (Artemisia), mixed with powdered charcoal, in a conical form. This is ignited, applied to the skin, and allowed to burn slowly until extinguished. The flesh is severely burned, with the resulting scar alluded to. As if this were not sufficient to expel the 'winds and vapors,' which they and the Chinese believe to be the cause of all diseases, this is combined with acupuncture, the needle passing through the moxa deeply into the tissues, and conveying the heat to the supposed seat of disease. As they employ this every spring as a preventive measure, it is rare to see a coolie without these scars. The accoucheur calls it to his aid, and is directed to burn three cones on the little toe of the right foot to accelerate the operation of nature. Even infants are thus tortured. A child about three years old, suffering from a wasting diarrhoea, who had thus been uselessly tormented, was brought to me; the many wraps having been removed, a simple water dressing and mild opiate brought the little creature round all right in two days. SAMUEL KNEELAND.

The least bittern in Newfoundland.

While on a recent visit to Newfoundland, I examined a mounted specimen of the least bittern (Ardetta exilis) that had been killed in a fresh-water marsh about a mile from St. John's, in the early part of October, 1882. The latitude of St. John's is 47° 33′ N., and it is hardly necessary to add that this species has not previously been recorded from so far north. C. HART MERRIAM, M.D.

Locust Grove, New York.

Science for workingmen.

Your article in the number of SCIENCE for April 20, upon this topic, was timely and suggestive. The example offered by the Baltimore and Ohio railroad is indeed worthy of imitation. But such work, however novel it may be in the east, has been done to a greater or less extent in this state for several years. It may interest your eastern readers, who sometimes think that we westerners must always wait for them in such matters, to know of a few attempts here to do similar work for the working-classes. Three years ago the officers of the St. Louis and San Francisco railroad maintained, with the hearty co-operation of its friends, a course of lectures in at least one important town on its line of road, for the special benefit of the railroad employees.

Two winters ago the Crystal plate-glass company, whose works, situated about thirty miles from this city, bring about them a population of nearly fifteen hundred, arranged a similar course of instruction lectures, which were attended by audiences of six and eight hundred persons.

The president of the St. Joe lead-mines at Bonne Terre, about seventy-five miles south-west of St. Louis, has just begun a like work, and intends to provide a good course of practical lectures, or talks upon science, literature, and travel, for the coming winter.

At Bonne Terre and at Crystal City, reading-rooms and libraries have been opened for all who choose to avail themselves of such opportunities; and at the former place a public reading from some standard author is given every Friday evening. The results attending such efforts to help working men and women have been sufficient to encourage these and other corporations to go on to still better things. The knowledge conveyed, and impulse given to thought and study, are only a part of the good done. A better relation between employers and employed is sure to come from the good feeling which prompts such action, and the grateful appreciation with which it is received.

Washington university is in this matter willing to take the position assumed by Johns Hopkins university in Baltimore, and has some half a dozen or so among its busy professors who are always ready to respond heartily to such calls for help. This institution has, in fact, been the main dependence of the corporations above mentioned in their efforts to do something to entertain and instruct their people.

We have accomplished but little here yet, but it may not be amiss to put ourselves on record as having begun. It helps us, always, to know what others are trying to do. M. S. SNOW.

Washington university, St. Louis, May 2.

Robins, sparrows, and earth-worms.

An amusing bit of impertinence on the part of the immigrant house-sparrow is seen in his habit of stealing earth-worms from our great lumbering, native American robin. As everybody knows, the robin is not a little skilful in extracting earth-worms from their burrows in land covered with short grass, as in pastures, lawns, and yards. The bird quickly detects the worm's head, as the creature lies resting near the mouth of its burrow, and seizes it instantly by a sudden blow with the beak. The head of the worm once firmly grasped, the robin straddles his legs apart, braces himself firmly, and gradually lifts his head to the uttermost, and thus slowly, by what is manifestly a powerful and a fatiguing effort, drags out the resisting worm. Having succeeded in an important enterprise, the bird very naturally pauses for a moment to take breath; and at this critical instant of time a sparrow steps forward, out of a squad of these birds which have been watching the robin's proceedings, quietly takes the worm from the robin's mouth, and incontinently flies away with it, leaving the original possessor in blank amazement. The transaction is well worth seeing for its own sake, and needs but to be looked for, in order to be seen frequently in and about our cities; and it suggests a question which may, perhaps, be profitably studied by the coming generation of naturalists. Indeed, the fact itself is worth putting upon record as a sort of bench-mark to serve as a point of comparison for observers in future years.

The fact being as stated, the question is, What is the tribe of robins going to do about it? It is idle to suppose that the whole race of robins will continue for long to 'get left' in this way, or that they will accept the sparrow's system of pillage as a finality, to be submitted to as a part of the fundamental plan of life in this best possible of worlds; and it will be of interest for future observers to notice in just what manner the conflicting interests of the two birds shall, in the fulness of time, have been composed. At least four lines of conduct would seem to be open to the robin: he might thwack the offending sparrow at the moment of his wrong-doing, or, indeed, all sparrows, both as a preliminary to the hunting of worms and on all convenient occasions, though these operations would doubtless be somewhat laborious; possibly he might learn to swallow the worm *instanter*, or perhaps even to fly away with it quickly enough to elude pursuit; or he may, in despair, wholly give up the pulling of worms. So far as my own observation goes, though it must be said that it has been confined to no great number of individual robins, it would seem as if no inkling of either of these plans has yet occurred to the suffering bird. In so far as I have myself seen, each particular robin, when thus defrauded, looks and behaves as if he did not clearly comprehend what had become of his worm; and he speedily goes in search of another, as if, on reflection, he had concluded that he must have himself swallowed the first. Meanwhile, a number of the sparrows who had flown off in chase of the first robber with intent to share his booty have returned, and are hanging around the robin in readiness for his second stroke. The probabilities that the robins will eventually find out some way of circumventing the thieving sparrows seem stronger when we reflect that it is probably only a very short time, comparatively speaking, since the robins began to pull earth-worms, anyway, and consider how thoroughly well they now do this work. To all appearances, a parcel of scattered robins hopping about in a pasture are attending to any thing but business. It is hard to believe, at first sight, that the birds are seriously searching for food; for each one of them is continually stopping and standing still in an apparently aimless way, as if distracted. In point of fact, the bird, when quiet, is intently watching for earth-worms in their burrows; and it is more than probable that he is not helped at this stage of proceedings by a group of sparrows hanging expectant about him. When the worm, or the place where the worm is, is perceived, the movements of the robin are sufficiently direct and forcible, as has just been stated. Inasmuch as there is good reason to believe that earth-worms were not to be found at all in this New-England country before its settlement, and that, even if they did exist, they were rare, it would seem that the robins must have learned the trick of capturing them within the last two hundred or two hundred and fifty years. Even if it be supposed that the earlier robins may have practised somewhat analogous movements with regard to certain kinds of insects or their larvae, it will still be reasonable to suppose that the first lesson, how to detect and pull the worm, must have been intrinsically harder than the one now before the robins of the period; viz., how to keep and hold the worm in spite of the pygmy sparrow. F. H. STORER.

Intelligence of the crow.

IN SCIENCE, No. 13, is a letter with this title, which I read with much interest, for the story is a very pretty one, and it is too bad to disturb it; yet I can but think the writer mistaken in the bird, for he says, 'It seems that we had been strolling too near their nests in the walls.' Now, it is well known that crows do not build in walls or cliffs; and none of the crows which I have ever kept in confinement ever used their claws with which to carry either food or other materials. I kept a raven for several years, which had its liberty, but always came for food when called. I never saw it carry food or any thing else in its claws. I have known it to carry off its own rations, rob both dog and cat of theirs, making at *least* three pieces, all of which it carried away in its beak at once, never in its claws. During the summer of 1882 I was living near high wooded cliffs, on one of which this raven built a perfect nest. It seems to me your correspondent must be mistaken.

Dorchester, Mass. JOS. M. WADE.

Sun's radiation and geologic climate.

In saying that the hypothesis of a diminution of solar radiation through the dissipation of solar energy would be admitted by 'most students,' I did not intend to include myself, for I am really a dissenter. In my judgment, the weight of the cumulative geologic evidence for the great age of the earth is not counterpoised by the arguments thus far adduced from the physical side of the question. I therefore welcome Mr. Warring's note (SCIENCE, No. 14) in that it helps to show that the physical conditions involved in the discussion are not so simple as some have assumed them to be. Perhaps we may go a step farther, and say, that even if it is demonstrated that solar energy is being dissipated, and if it is demonstrated that in consequence of this dissipation the temperature of the sun is either falling or rising, the relative intensity of solar radiation still remains an unsolved problem. The rate of radiation is a function of other conditions besides temperature, and notably of the nature of the outer envelope of the sun. It is quite conceivable that changes in the envelope, belonging to the chemical history of the sun, might materially modify any law of variation based upon a theory of progressive dissipation of energy. This suggestion is, of course, without experimental basis; but in this respect it does not stand alone. Our laboratories fall so far short of realizing solar conditions, that solar physics and solar chemistry cannot be conceived without the aid of the imagination.

G. K. GILBERT.

Marking geodetic stations.

Of the many hundred Coast-survey stations that have been marked at different dates within the limits of the state of New York, only a very small percentage have now, or ever have had, surface-marks of any description, and but few of the underground marks can be recovered without re-measuring angles of the triangulation.

The manner of marking stations is apparently left to the judgment of the Coast-survey assistants. The writer of the manual 'On the field-work of triangulation,' issued by the Coast-survey, neglected to place surface-marks at several of the primary triangulation points occupied by himself in the vicinity of Albany.

A substantial surface-mark has been placed at every geodetic station of the New York state survey; and although some have been mutilated, so far as is known, none have been removed. The number of granite surface-marks that have been placed by the survey is at present three hundred and twenty-nine.

HORACE ANDREWS, Jun.,

Albany, May 12, 1883. *Assistant N. Y. state survey.*

THE SYNTHESIS OF MINERALS AND ROCKS.

Synthèse des mineraux et des roches; avec une planche en photochromie. Par *F. Fouqué et A. Michel-Lévy.* Paris, *Masson*, 1882. 423 p. 8°.

THE great value of synthesis in any department of scientific inquiry is undoubted; but the difficulties connected with it are in most cases so discouraging, and the results obtained so unsatisfactory, that an additional interest attaches to experiments so brilliantly successful as those recently performed in Paris by Messrs. Fouqué and Lévy in the artificial reproduction of volcanic rocks. It is to the French that we owe almost every thing that has thus far been accomplished in synthetical mineralogy; and we can but hail with delight the achievements of these two gentlemen, who have added new lustre to the French name by carrying the synthesis one step farther. They have produced in the laboratory, not only a large number of the rock-making minerals, but have produced them in their natural associations, as they go to make up integral parts of the earth's surface.

The book before us is to a great extent a compilation, giving a bibliography, and a short *résumé* of the processes by which mineral species have thus far been artificially obtained. Valuable as this is for reference, it is in the first eighty pages of the work that its principal interest lies. Here we are presented with a systematic account of the authors' own experiments, which it has heretofore been very difficult to obtain from the numerous short articles scattered through various periodicals which have appeared during the past four years.

The first chapter is a general introduction, containing, first, the five conditions which an artificial product must fulfil in order to be a successful synthesis. Then are noted several circumstances, which, during late years, have been especially conducive to synthetical investigations in the department of mineralogy and geology, and the great benefit which these sciences have derived from such investigations. A classification of the various methods made use of in the artificial reproduction of minerals follows; and the chapter closes with an arrangement of the crystalline constituents of the earth's crust, for purposes in hand, in four categories, as follows: —

1°. *Volcanic* (basic) *rocks;* i.e., plagioclase rocks, and those free from felspar.

2°. *Acidic rocks;* i.e., those containing quartz or orthoclase (granite, rhyolite, etc.).

3°. *The crystalline schists* (gneiss, mica-schist, etc.).

4°. *Mineral veins.*

The minerals of the first of these categories, and their natural associations, have nearly all been reproduced by simple fusion; those of the last, by volatilization or solution. Those of the remaining two categories have not yet been artificially reproduced with entire success.

The second chapter is devoted to the account of the authors' own experiments, and a discussion of their results. This is preceded by a brief history of what had been before accomplished in this line. Attempts to reproduce mineral associations by means of superheated water had yielded nothing satisfactory, and even the method of pure igneous fusion, so often tried, had only produced results that caused the most eminent geologists, in most recent years, to declare that Nature must employ far different means in the formation of her lavas than stands at the command of the laboratory.

The apparatus with which the syntheses were performed was very simple. The substances to be fused were placed in platinum crucibles, incased in coverings of fireclay. These were heated by a blast of ordinary illuminating-gas in a Leclerc and Forquignon furnace. Four grades of temperature were made use of, designated by their numbers as follows: —

No. 1. Melting-point of platinum. Sufficient to reduce anorthite, leucite, and olivine to a vitreous mass.

No. 2. Melting-point of steel, also of all the felspars except anorthite, and of the bisilicates.

No. 3. Between the melting-points of steel and copper. Pyroxene and nepheline fuse readily.

No. 4. Where copper fuses with difficulty.

The associations of various rock-making minerals were readily obtained by the employment of the principle, already well known to Hall, *that the fusing-point of a crystallized silicate is in general higher than that of the same chemical compound in an amorphous state.* If, therefore, a melted silicate glass be held for a time at a temperature between the fusing-point of some mineral whose constituents it contain, and its glass, crystals of this mineral will form in the molten mass; now, if the temperature be lowered sufficiently, the next less easily fusible mineral may be obtained; and so on. It is then the rule that *the minerals crystallize out of the magma in the inverse order of their fusibility.* This rule is abundantly verified for the class of rocks capable of synthesis

by fusion, both by the study of natural and artificial products, with a few apparent exceptions, which receive a special explanation.

By a judicious combination of substances and temperatures, the authors succeeded in obtaining eleven distinct mineral associations, almost exactly reproducing, even in the minuest details of structure, as many natural rock types.

These are as follows: 1°. *Augite (oligoclase) andesite*, 2°. *Augite (labrador) andesite*, 3°. *Augite (anorthite) andesite* (all produced by single fusion at temperature No. 3); time three days. 4°. *Basalt.* Two successive stages of fusion were necessary to produce this rock. Temperature No. 2 produced in forty-eight hours numerous crystals of olivine embedded in a glassy matrix, which was altered into a crystalline mass of labradorite and augite microliths by being again subjected for an equal length of time to temperature No. 4. 5°. *Nephelinite* was produced in forty-eight hours at temperature No. 4. 6°. *Leucitite* was obtained after three days' fusion at temperature No. 2. 7°. *Leucititephrite* produced by double fusion exactly like basalt. 8°. *Lherzolite*, 9°. *Meteorites free from felspar*, and 10°. *Felspathic meteorites*, though quite successful so far as the mineral associations were concerned, showed certain variations from the natural products in their structure. No synthesis was perhaps so interesting as that of 11°. *Diabase*, with the so-called 'ophitic' structure. This structure consists, as is well known, of irregular masses of pyroxene filling the spaces between the lath-shaped crystals of plagioclase. It was found to be impossible to reproduce this structure with oligoclase or labradorite, on account of their comparatively low fusing-point. By means of a double fusion with anorthite, it was, however, successfully accomplished.

Scarcely less interesting than these positive results are the conclusions derived from the authors' negative experiments. It was found impossible to obtain the acid rocks, i.e., those containing either quartz, albite, orthoclase, muscovite, biotite, or amphibole, by purely igneous fusion. These minerals either produced an amorphous mass, or passed into other combinations giving rise to species already obtained; e.g., hornblende, when melted, crystallized as pyroxene. Thus the very important conclusion is reached, that the acid rocks owe their origin to some other agency than simple fusion.

Under the head of the synthesis of minerals, the authors' experiments in fusing mixtures of felspars are worthy of special notice as being directly opposed to the now generally accepted theory of Tschermak, that the triclinic felspars form an isomorphous series. Fouqué and Lévy found it impossible to obtain crystals of intermediate members, as only well-defined microliths of either oligoclase, labradorite, or anorthite, appeared, varying in their relative proportions with the mixtures fused. Also of especial interest are their artificial production of felspars with lead, barium, and strontian as bases.

THE GEOLOGY OF NATAL.

Natal. Department of mines. Report upon the coal-fields of Klip River, Weenan, Umvoti, and Victoria counties, together with tabulated statement of results obtained from a series of trials of colonial coal upon the Natal government railways. By F. W. North. London, *Harrison, pr.*, 1881. 1, 66 p., (49) pl., etc. f°.

This report contains two maps, showing the distribution of the coal-fields of the colony of Natal, and a description of 72 sections occurring in them, 70 of which are illustrated by diagrams. There are also two horizontal sections given, — one from Buffalo River to the Drakensberg Mountains, and the other from Buffalo River to Elands Laagte.

Mr. North estimates the actual area of the Natal coal-field, where he has found workable coal-seams at the surface, at about 1,100 □ miles, situated entirely in Klip River county. To this he adds 250 □ miles for the region between the Ingagani River and the Drakensberg Mountains, which he considers the coal measures underlie. The workable seams vary from 4 to 10 feet in thickness, and are of several qualities. Assuming an average thickness of 4 feet, and allowing a deduction of 50 per cent for faults, worthless coal, and barren ground, he estimates the whole at 2,073,000,000 tons, divided into, —

	Tons.
Anthracite, similar to Gladstone . . .	518,400,000
Semi-bituminous, similar to Walmesley,	518,400,000
Bituminous, similar to Dundee coal-fields and Lenox sections	518,400,000
Free-burning bituminous coal of the same character as No. 44 Crown lands and Lenoxton, Newcastle .	518,400,000
Total	2,073,600,000

Mr. North considers these coals superior in quality to those of Cape Colony. A number of analyses of them have been made by Dr. Frankland and Dr. Hahn. There are also many beds of iron ore: the one from Prestwick is an intimate mixture of magnetic iron ore and

brown iron ore, and yielded on analysis 63.51 per cent of metallic iron.

Accompanying the report is a "Horizontal geological section on the main road from Durban to Van Reenen's pass, by Dr. P. C. Sutherland." This, in so far as it covers the same ground, differs considerably from that published by C. L. Griesbach in 1871. The Table Mountain sandstone, referred by Griesbach to the carboniferous, is by Sutherland considered Silurian. The mesozoic eruptive rocks are joined together under the name of basaltic, and are apparently represented as dikes, and not as interstratified flows of melaphyr, amygdaloid, and aphanitic diorite, as by Griesbach.

Mr. North gives the following geological order of succession in the rocks of Natal: —

1. Basaltic trap rocks, often penetrating between stratified rocks or shales of the coal-measures, and forming horizontal beds.

2. Triassic horizontal coal-measures, containing coal-seams correlating with the Stormberg coal-field of Cape Colony.

3. Pietermaritzburg shales, probably corresponding with the upper Karroo beds of Cape Colony.

4. Conglomerate or bowlder clays, in all probability the Dwyka conglomerate of Cape Colony.

5. Sandstones, horizontal and massive, of the Inanda location, Table Mountains, and Bothas Hill, etc., probably of Silurian age.

6. Primary rocks, — granite, gneiss, marble, etc.

Mr. North seems to have overlooked the cretaceous series, from the lower greensand up to the white chalk described by C. L. Griesbach in south-eastern Natal; and no evidence is given for assigning the Table Mountain sandstone to the Silurian instead of the carboniferous: in fact, no notice whatever is taken of Mr. Griesbach's able work on the geology of Natal.

At the Insiswa Mountains, in the Amaponda territory, the line of demarcation between a vast eruption of igneous rock and the triassic contains various ores of copper containing traces of gold. Mr. Griesbach also mentions the occurrence of copper ores along the line of the eruption of melaphyrs. We have here, in another portion of the world, another instance of the occurrence of cupriferous traps in the trias.

The bowlder clay consists of a bluish gray base, so fine that its constituents are not resolvable except under high magnifying power, and then no crystals are disclosed. It appears to be a very fine indurated mud, containing bowlders, pebbles, angular fragments, and grains of a great variety of rocks varying in size from masses weighing over 5 tons to pieces smaller than a pea. In mechanical composition it greatly resembles the great Scandinavian drift. It stretches for hundreds of miles, and has been found 1,200 feet thick. Some of the larger angular bowlders seem to have been brought from a distance of at least 70 miles. It seems difficult to account for such a formation otherwise than by glacial action at the close of the dyassic period.

THE BIBLIOGRAPHY OF ANGLING.

Bibliotheca piscatoria. A catalogue of books on angling, the fisheries, and fish-culture, with bibliographical notes and an appendix of citations touching on angling and fishing from old English authors. By T. WESTWOOD and T. SATCHELL. London, *Satchell*, 1883. 397 p. 8°.

THE possibilities of the future in the formation of libraries on special subjects, at present rates and ratio of increase in book-making, are brought forward in a striking manner by examination of a list like that before us. Here is a work devoted to angling, fisheries, and fish-culture, in which 2,148 distinct publications are registered under 3,158 entries, inclusive of new editions and reprints. Angling occupies 245, fisheries 83, and fish-culture 23 pages. Roughly estimated, nearly ten per cent of the publications, including reprints, etc., have appeared since 1870. Fish-culture alone claims an increase of nearly one-third in the same time. It is hardly to be expected that a work of this character should be entirely exhaustive or complete. The authors deserve great credit for the nearness of their approximation to completeness, for the amount and quality of information given, and for general accuracy.

An example or two will indicate respects in which the book may be improved in future editions.

"*Gesner* (Conrad). Aqvatilivm animantivm nomina Germanica et Anglica, serie literarum digesta, authore Conrado Gesnero. [1530?] 8°. Appended to an edition 'P. Ovidii Nasonis Halieuticon, etc.' Tigvri apud Gesneros fratres, pp. vi+ 280, and extending from page 12 to 280. . ."

This should read, —

Gesner (Conrad). De piscibvs et aqvatilibvs omnibys libelli III. Noui. Avthore CONRADO GESNERO Medico et philosophiae naturalis interprete in Schola Tigurina.

I. Scholia et emendationes in Halieuticon P. Ouidii Nasonis. [pp. 1–11.]
[Second title.] P. Ovidii Nasonis Halievticon liber.

II. Aqvatilivm Animantium Enumeratio iuxta Plinium, emendata et explicata serie literarum. [pp. 12–92.]
[Running titles.] Catalogvs Aqvatilivm, and Divisio Aqvatilivm.

III. Eorvndem Nomenclator Germanicus longe copiosissimus. Et alia quaedam ad Piscium historiam pertinentia. [pp. 93–280.]
[Running title.] Teütsche namen der Fische vnd Wasserthieren.
Tigvri apud Andream Gesnerum F.
[Date of Prefaces 1556.]

In consequence of the foregoing, after *Ovidius Naso* (Publius), "Halieuticon: hoc est, de piscibus libellus, mute quam ante hac emendatior et scholiis illustratus . . . per Conradum Gesnerum. Tiguri apud Gesneros fratres [1530?] 8°" should give place to the following: Part I. of Gesner's De piscibvs et Aqvatilibvs, "Scholia et emendationes in Halieuticon P. Ovidii Nasonis." "P. Ovidii Nasonis Halieuticon liber." pp. 1–11. Tigvri apud Andream Gesnerum F. [1556.]

The date for the first Frankfort edition of Aldrovandi is 1623 instead of 1629; and Gronow gives that of the second as 1640 instead of 1645. That given by the latter as Venice, 1616, is omitted. Three editions of Aelian (1556, 1611, and 1616), given by some authorities, do not appear. Future revision of the work will probably introduce the names of such works as those of Schomburgk's Fishes of British Guiana (1852), and Spix and Agassiz' Fishes of Brazil (1829), both of which give information on angling. The latter figures on plates A to G the various methods of capture in use among the natives.

Our authors have given us a work of great importance to all interested in the subjects of which it treats.

WEEKLY SUMMARY OF THE PROGRESS OF SCIENCE.

ASTRONOMY.

Mass of a planet from observation of two satellites. — M. Struve recommends measurement of the positive angle and distance of a satellite from another satellite, and not from the primary planet. A series of such measurements on satellites of Jupiter has been begun at Pulkova. The observations occupy one-third the time, and are considered two or three times as accurate as those by direct reference to the centre of the planet. They are free, moreover, from the unknown constant errors inseparable from the latter, — an advantage which Prof. A. Hall, in this paper, considers cheaply purchased at the price of greater difficulties in computation. He shows, that, while the solution of six normal equations requires seventy-seven auxiliary quantities, that of twelve (the elements of both orbits being involved by the new method) requires four hundred and forty-two, and therefore nearly six times the labor. But these twelve equations give the period and mean distance of each satellite, and hence two values of the planet's mass. Mr. W. B. Taylor objected to such special designations as 'peri-Saturnian,' 'apo-Jovian,' for the apsides of satellites' orbits when general names were needed. He suggested 'peri-apsis' and 'apo-apsis.' — (*Phil. soc. Wash., math. sect.; meeting* April 26.) [919

Periodicity of auroras. — Professor Sophus Tromholt has discussed the observations of auroras made by Prof. S. Kleinschmidt at Gotthaab, in Greenland, from 1865 to 1880, together with other observations in northern latitudes, and finds that for polar regions the maximum of auroras corresponds with the minimum sun-spot period, the reverse of what has been noted in temperate zones. The yearly maximum is at the winter solstice, while, in lower latitudes, maxima occur at the equinoxes. Weyprecht has shown that the yearly maximum is due to an oscillation of the auroral zone toward the south at the equinoxes, and toward the north at the solstices. The same explanation is given of the eleven-year period, corresponding with the sun-spot period. Prof. Lemström's production of an artificial aurora is mentioned. — (*Observ.*, April, 1883.) M. MCN. [920

Report of work of the Royal observatory, Cape of Good Hope. — In the report for 1882, Dr. Gill states that the observations for the difference of longitude between the observatory and Aden are completed. The great comet was observed on every clear night from Sept. 7, and photographs were obtained on six nights The heliometer measures for the parallax of certain southern stars are nearly concluded. In connection with observations in the northern hemisphere, *Victoria* and *Sappho* have been observed for determining the solar parallax by Galle's method. Time of contact at the transit of Venus was noted by six observers, and heliometer measures were made during the transit. — (*Monthly not.*, March, 1883.) M. MCN. [921

MATHEMATICS.

Infinitesimals. — Mr. M. H. Doolittle looks on infinitesimals, differentials, and zero as having the same denotation, but different connotations. He proposes, in cases where the value of a function becomes indeterminate, to call that value which is continuous with those for preceding and succeeding values of the variable the *serial* value. The differential coefficent, in this view, is the serial value of the ratio of two increments when those increments become zero. — (*Phil. soc. Wash., math. sect.; meeting* May 9.) [922

PHYSICS.

Electricity.

On secondary batteries. — Professor Barker gives a brief history of secondary batteries from the discovery of electrolytic polarization by Gautherot, in 1801, to the invention of the Faure cell, together with the results of his own experiments upon cells of this latest form.

In charging his series of thirty-four cells by means of a Gramme machine, he used, in order to prevent discharge by a current backward through the machine when the electro-motive force of the latter fell, a 'cut-out,' in which an electro-magnet, through which the current flows, forces the end of a metal bar against a spring, pressing it down, and thus keeping the circuit closed while the current flows in the desired direction. When the current begins to fail, the reaction of the spring opens the circuit.

Using this cut-out, Prof. Barker found that the secondary battery could be employed with great advantage in steadying the current furnished to a series of Edison lamps by a Gramme machine driven by a gas-engine. For this purpose he connected the Gramme and the battery as if for charging, the cut-out being in the circuit, and connected, also, the poles of the battery with the lamps. The electro-motive force of the machine was made very nearly equal to that of the battery, so that, just after each explosion in the gas-engine, the machine prevailing sent a current through the lamps, and also a small current through the battery, slightly charging it; but, before the next explosion occurred, the electro-motive force of the machine had fallen to such a point that the battery now sent a current to the lamps. It is stated, that, although the engine gave only one explosion in four strokes, the pulsations in the light entirely disappeared when the above arrangement was adopted.

Prof. Barker states that his experiments entirely confirm those of Gladstone and Tribe as to the formation of lead sulphate when a secondary cell remains in open circuit. In several cases the acid of the cells disappeared entirely in this way, and lead sulphate formed the entire coating on both plates. On attempting to re-charge such a cell, the resistance was found to be very high, and torrents of gas were evolved from both plates. After a time the resistance fell to its normal value, and the waste of gases ceased, though not till a considerable quantity of energy had been lost.

It appears, moreover, that in the cells employed, although they were intended to be all of like dimensions and construction, there was great difference of storing-capacity and of resistance. After an hour's use on the lamp-circuit, different cells gave on a tangent galvanometer deflections varying from 87° to 0°. When the discharge was continued for a long time, so as nearly to exhaust the battery, it was found that many of the cells were reversed, so as to be now opposing the action of the others. "In place of continuing uniform as a single cell, the electro-motive force of a series of cells begins to fall when about half the charge which it ought to be capable of yielding has been drawn from it." In the Planté cell the local action is far less than in the Faure, the lead peroxide in the former being very much harder, so that not a trace of the sulphate was found in such a cell after six months of frequent use. Prof. Barker appears, therefore, to consider the Planté cell more promising than the Faure, in spite of the much greater time required to form it. — (*Proc. Amer. assoc.; Montreal meeting*, 1882.) E. H. H. [923

CHEMISTRY.

(*General, physical, and inorganic.*)

Ammonio-argentic iodide. — By digesting argentic iodide with a solution of ammonia, A. Lougi obtained the compound NH_3AgI. — (*Gaz. chim. ital.*, 1883, 86.) C. F. M. [924

Bleaching-powder and analogous bodies. — The constitution of this substance is again reviewed by Lunge and Naef. In 1882 Kraut objected to the formula, Cl — Ca — O — Cl, first proposed by Odling for the dry salt, and apparently confirmed, in 1880, by Lunge and Schaeppi. Kraut's objections were twofold. In the first place, he asserted that all the chlorine in bleaching-powder was expelled by a mixture of carbonic dioxide and hypochlorous acid, and, secondly, that bleaching-powder was analogous to the lithium salt (LiCl + LiOCl). In answering the first objection, Lunge and Naef affirm that Kraut must have started with a basic calcic chloride, which, with hypochlorous acid, gave, first, bleaching-powder, from which carbonic dioxide set free the chlorine, —

$$Ca\overset{Cl}{\underset{OH}{}} + HOCl = H_2O + Ca\overset{Cl}{\underset{OCl}{}}. - Ca\overset{Cl}{\underset{OCl}{}} + CO_2 = CaCO_3 + 2Cl.$$

They further assert that $CaCl_2$ may be decomposed by hypochlorous acid ($CaCl_2 + Cl_2O = CaOCl_2 + Cl_2$). Concerning the second point urged by Kraut, Lunge and Naef find that eighty-eight per cent of lithic hydrate is converted into the basic chloride, while, according to Kraut, fifty per cent only should enter into the reaction, if it is analogous to bleaching-powder. Chlorine is not eliminated from the lithium salt by carbonic dioxide at ordinary temperatures. At higher temperatures the chlorate is formed, and oxygen evolved. The strontium salt corresponding to bleaching-powder, when treated with carbonic dioxide, behaves in a manner strictly analogous to the calcium salt. The authors regard these facts as sufficient to establish the formula, Cl — Ca — O — Cl. — (*Berichte deutsch. chem. gesellsch.*, xvi. 84.) C. F. M. [925

Action of certain vegetable acids upon lead and tin. — Mr. F. P. Hall tried the action of acetic, tartaric, and citric acids upon lead, tin, alloys of these metals, and upon cans that had been used to preserve fruit. In a solution of approximately the same strength as common vinegar, these acids exerted a much greater corrosive action upon tin than upon lead, whether acting upon the metals separately or in the form of alloys. Both metals were dissolved freely, especially from the cans. The lead probably came from the solder, since it was not detected in the tin of which the cans were made. In the composition of tin foils, every variation was found between samples that were free from lead and those which contained a very high percentage of this metal. — (*Amer. chem. journ.*, iv. 440.) C. F. M. [926

(*Analytical.*)

Direct estimation of chlorine in presence of bromine or iodine, and of bromine in presence of iodine. — According to the observations of G. Vortmann, metallic chlorides are not affected when boiled with the peroxide of lead or of manganese and dilute acetic acid, and only with difficulty by the concentrated acid. Bromides are decomposed by plumbic, but not by manganic peroxide, while iodides are readily decomposed by either. To determine chlorine in presence of bromine, the latter may be expelled by evaporating the solution to dryness with plumbic peroxide and dilute acetic acid. Iodine may be expelled from a mixture of a chloride and an iodide by either plumbic or manganic peroxide and acetic acid. Manganic peroxide is also used to decompose an

iodide in presence of a bromide. In a mixture of the three haloid salts, both bromine and iodine may be removed by plumbic peroxide; or first the iodine by manganic peroxide, and then the bromine by plumbic peroxide. These methods fail to give accurate results when the relative percentage of chlorine is small. — (*Sitzungsber. kais. akad. Wien*, lxxxvi. 244.) C. F. M. [927

AGRICULTURE.

By-products from rice. — The chief by-products of the preparation of rice for market are 'douse,' or bran, 'rice-flour,' and 'polish.' The bran consists of the hull, or pericarp, with a portion of the outer proteine-bearing layer of the true seed adhering to it. The rice-flour is produced by pounding the grain, freed from the hull, in wooden mortars, to complete the removal of the testa and proteine-bearing layer of the seed. It consists of the latter mixed with more or less of the starchy interior portion of the seed. The rice then passes under stiff brushes, which remove the last traces of the outer layer, and more or less starch. The refuse from this process is the rice polish. Analyses of these materials indicate that they are valuable feeding-stuffs, and show them to be decidedly rich in fat and proteine. — (*Rep. N. C. exp. stat.*, 1882, 87.) H. P. A. [928

Analyses of cotton-seed. — The following analyses of the hulls and kernels of cotton-seed were made at the North Carolina agricultural experiment-station.

	Kernels.	Hulls.
Water	6 27	9.16
Ash	4.03	2.28
Proteine (N × 6.25)	29.25	2.19
Crude fibre	4.38	47.12
N. fr. extract	19.52	38.67
Fat	36.55	0.58

The whole seed consists of about equal parts of kernels and hulls. The ash of both hulls and kernels is very rich in potash and phosphoric acid.— (*Rep. N. C. exp. stat.*, 1882, 97.) H. P. A. [929

GEOLOGY.

Lithology.

The Rastenberg granite. — This rock, microscopically studied by Koller, is a porphyritic granite composed of quartz, orthoclase, plagioclase, biotite, and hornblende. These form a medium crystalline mass in which large orthoclase crystals are embedded. Dihexahedral quartz, which is usually present in such rocks, was absent from this. The orthoclase was found to belong to the microperthite variety. While the large crystals were orthoclase, the smaller ones were mostly plagioclase, lying between oligoclase and albite, or, according to Tschermak's theory, between Ab_2An and Ab_1An_3. The absorption and pleochroism of the hornblende were not strong. The colors were, for a, light yellowish-brown; c, clear grass-green; b, dark brownish-yellow; while $a < c < b$. — (*Min. petrog. mitth.*, v. 215.) M. E. W. [930

The rocks of the Wechsels. — In a paper relating to the lithology of the Wechselgebirge, by Böhm, the rocks are classified as, 1°. Micaceous rocks, divided into albite-gneiss, granulitic-albite-gneiss, mica-schist, epidotic-mica-schist, and quartzite; 2°. Chloritic rocks, into chlorite-gneiss and chlorite-schist; 3°. Hornblendic rocks, into diorite-schist and hornblende-epidote-schist. Descriptions of the microscopic characters are given. Rutile and titanite were found in the rocks, while an observed indistinct striation of the quartz was said to be caused by fluid or glass inclusions. — (*Min. petrog. mitth.*, v. 197.) M. E. W. [931

Rhyolite from Yellowstone Park. — Chemical analyses of two specimens of rhyolite have been made by Mr. W. Beam with the following results: —

Sp.gr.	SiO_2.	Al_2O_3 + Fe_2O_3.	CaO.	MgO.	Na_2O.	K_2O.	(Ignition) H_2O.	Total.
2.40	77.00	13.40	1.25	1.19	3.43	3.62	0.70	100.59
2.60	77.90	14.55	0.40	trace.	2.10	4.63	1.00	100.58

Since but little ferric oxide was obtained, it was estimated with the aluminia. The rock in the first analysis is stated to be a porphyritic obsidian, and, in the second, a quartz trachyte. These names and the analyses indicate that the rocks are rhyolites. — (*Amer. journ. sc.*, xxv. 106.) M. E. W. [932

Meteorites.

The Atacama (Bolivia) meteorite. — This supposed meteorite has been regarded as a pallasite or syssiderite (SCIENCE, p. 41), according as the classification of G. Rose or Daubrée is followed, closely allied to the Siberian form found by Pallas. Dr. S. Meunier dissents from this opinion, although holding that both are specimens of concretionary veins (SCIENCE, p. 18), — a view for which the present writer is unable to see any basis. A chemical and mineralogical examination showed, according to Meunier, that the non-metallic part had the following composition: —

Pyroxene	9.00
Schreibersite	4.00
Chromite	1.20
Anorthite	0.10
Pyrrhotite	0.50
Olivine	85.20
	100.00

— (*Comptes rendus*, xcv. 1384.) M. E. W. [933

The Mocs meteorite. — Professor A. Koch has continued his papers on the fall of meteoric stones in the vicinity of Mocs in the Siebenbürgen, Feb. 3, 1882. He reports from this fall 912 pieces, weighing collectively 174,113 gr. A chemical analysis, made by his brother, Frank Koch, showed that their average composition was as follows: —

SiO_2	42.74	Mn	0.57
Al_2O_3	trace	Ni	1.38
Fe	7.93	Co	trace
FeO	20.86	S	2.61
CaO	2.78	P	0.41
MgO	15.95	C?	0.19
Na_2O	1.20	Chromite	1.56
K_2O	0.21		
Li_2O	trace		
MnO	1.12	Total	99.51

Koch states that the meteorite fragments are composed of nickeliferous iron, magnetic pyrites, taenite, and silicates. The chemical analysis indicates that they belong to the peridotites. — (*Min. petrog. mitth.*, v. 234.) M. E. W. [934

MINERALOGY.

Löllingite. — Mr. W. F. Hillebrand described an interesting variety of this mineral, recently found on Teocali Creek, Gunnison County, Col. It occurs in aggregates of spheroidal bodies, showing radiate structure when broken, in a gangue of calcite or ba-

rite, and associated with proustite, argentite, native silver, and other minerals. — (*Col. scient. soc.; meeting* April 2.) [935

PHYSICAL GEOGRAPHY.

Ocean currents south of Africa. — On the charts published by the London meteorological office (1882) the following currents are shown at the meeting of the Antarctic, Atlantic, and Indian oceans: first, the Agulhas current, moving south-west along the eastern coast of Africa, with a velocity of 51 knots a day in summer (December to February), 46 in winter, and a maximum of 108. It is 4–5° C. warmer than neighboring water of the same latitude, and in summer carries a temperature of 25° C. to lat. 35°, and 21° to lat. 39°. As the water in Table Bay is much colder, it would seem that this current does not enter the Atlantic, except temporarily, in summer time, but, on meeting the Antarctic current about lat. 40°, long. 23° E., is turned back to the Indian Ocean in a north-easterly direction. That this is not a simple continuation of the Antarctic current is shown by its warmth, as well as by the rapid changes of temperature and the alternation of warm and cold bands about lat. 40°. Second, the Antarctic current south of lat. 40°, moving north-east or north-north-east. This is rather independent of the prevailing winds, which follow the parallels closely. As its strength and northward deflection are greatest, and its temperature and density are least, in summer, it is thought to be strongly influenced by the melting of Antarctic ice. West of long. 20° it gives off branches that flow north, along the west coast of Africa. — (*Ann. der hydrogr.*, 1883, 1, 63.)

At least the occasional passage of the Agulhas current into the Atlantic is shown by the drifting of a bottle thrown overboard off the coast of Natal (lat. 29° 24′ S., long. 33° E.) Dec. 7, 1880, and found on the coast of Brazil (lat. 17° 30′ S.) Aug. 11, 1882. The distance traversed was probably 4,500 nautical miles, or an average of over seven miles a day. — (*Id.*, 61.) W. M. D. [936

Earthquakes on the Armenian plateau. — H. Abich adds a chapter on earthquakes to his geological description of this region, which contains much of importance concerning the volcanoes and other physical features of Armenia, with fine illustrations in maps and views. The two chief seismic centres are the Ararat volcanic group and the Palandokän near Erzerum. At the former, in 1840, a great landslide was produced by a shock, of which Abich's previous description (*Verh. gesell. f. erdk. Berlin*, iv. 1845, 28) is here reprinted. At the latter, on May 21, 1859, strong vertical and horizontal oscillations were felt; and, in a few minutes after the first disturbance, over a third of the town's eight thousand houses were in ruins, and five hundred people were killed or mortally wounded. It was noticed that heavily-built houses suffered more than lighter ones, and that the destruction was much greater in the central, higher part of the city, which stood upon a rocky basis, than in the lower suburbs on the alluvial plain. The earthquake of Shemaka, May 31, 1859, is described in detail, and the general relation of the Armenian with the Mediterranean vulcano-seismic disturbances along the belt between latitude 37° and 40°, from the Caspian to the Atlantic, is discussed. An extended list, compiled from old Armenian chronicles, is added, showing fifty-two earthquakes from 350 to 1650 A.D., in many of which the destruction was very great. — (*Geol. forsch. kaukas. ländern.* ii., *geol. armen. hochlandes, westhälfte. Vienna*, 1882.) W. M. D. [937

The north German plain. — From the Straits of Dover eastward, between the flanks of the Eifel, Harz-, Erz-, and Riesengebirge on the south, and the shore of the North Sea and the Baltic on the north, the country is low and generally flat. Westward from the Elbe, the plain is hardly more than 20 met. above sea-level, except on the Luneberg heath, which rises to 80 met. Eastward from the Elbe, the highest ground is found in lake-plateaus (*seenplatte*) of Mecklenburg (about 100 met.), Pommerania (100), and Prussia (110), with plains of much less elevation and more level surface, both north and south. The gradual rise from the sea is also shown by the low levels of the Rhine (36 met.) at Cologne, 130 miles from the coast; the Weser (40 met.) at Minden, 100 miles inland; the Elbe (45 met.) at Magdeburg, 150 miles; the Oder (20 met.) at Frankfurt, 125 miles; and the Weichsel (41 met.) at Thorn, 110 miles. This flat surface does not end at the shore, but continues under the Baltic and the North Sea. In addition to the stratified sands and clays which cover a great part of this plain, it contains many large erratic bowlders and unstratified deposits, which have heretofore been generally considered the results of a great flood, or of iceberg transport; but recently these deposits have been closely examined, and within the past five years a large number of German geologists have found reason to believe that their low northern country was invaded in post-tertiary time by an ice-sheet extending outward from Scandinavia. Bernhardi (1832) was the first to make such a supposition, but looked to the polar regions for the source of the ice. After him came Agassiz and Naumann (1844); but their observations were overlooked, until, in late years, Berendt, Credner, Helland, Penck, and others, all denied the importation of erratics by floods or by icebergs, and contended for the action of land-ice. Their results are summarized by Th. H. Schunke, briefly as follows: the unconsolidated deposits of north Germany consist, in part, of stratified sands and clays, with land, fresh and marine fossils, for which no explanation has been generally accepted, except that it was accumulated under water; and, in part, of compact, unstratified sheets of drift containing numerous subangular stones, 90 % of which are foreign (from Scandinavia, etc.), 80 % are scratched, and many are of great size. Stones of local origin are carried against the present direction of river-flow, and sometimes to a higher level than their source. Several of the few rock ledges appearing through this drift-covering have been found rounded and striated; and the clayey strata that often underlie the unstratified drift are discovered greatly disturbed, compressed and folded. Pot-holes are very common. All this is best explained by glacial action, perhaps alternating with open water and floating ice. No terminal deposits are yet found, clearly marking the farthest advance of the ice; but the lake-plateaus, a little way inland from the Baltic coast, have all the characteristics of terminal moraines. Elsewhere the surface is lower and more even, being generally levelled off with a sheet of stratified sand, or covered with still more recent moors. The rivers are moderately depressed below the general surface. It has been suggested that the Weichsel and Oder were displaced from their lower courses when the ice-sheet reached the '*seenplatte*,' and then turned westward, near Bromberg and Frankfurt, to join the Elbe above Wittenberg, their old east-to-west channel being much larger than the streams which now occupy it. Although the action of land-ice is thus generally admitted, many questions are by no means settled; notably, the character of the water-basins in which

the stratified deposits were laid down, and the double or treble alternation of these with sheets of unstratified drift. — (*Kettler's zeitschr. wiss. geogr.*, iii. 1882, 101, 138.) W. M. D. [938

BOTANY.

(*Physiological.*)

Formation of cystoliths. — These concretions are very abundant in the tissues of many families of plants; notably, the nettles, hops, and elms. Chareyre traces what he considers a plain connection between these epidermal concretions in this group and the hairs over them. In some cases the calcification begins high up in the hair, and, having proceeded as far as its base, gives rise to a concretion at the surface of the leaf, but in most cases goes on to form a calcareous mass below this. This subepidermal concretion is the cystolith. It is an interesting fact that similar concretions should occur in perfectly smooth leaves of closely allied plants. Did these once possess hairs of like character? — (*Comptes rendus*, April 9.) G. L. G. [939

Rate of growth of desert-plants. — Capus has added some interesting facts to our knowledge of the vast influence of plenty of water upon growth. In the botanic garden at Samarcande, Turkestan, he found that Ailanthus glandulosus grew, during the first year, .21 of a metre; it grew .33 in the second, and .89 in the third, — all of which were years in which no irrigation-water was furnished. In the fourth year, *with* water, the growth was 10 metres. He thinks that this tree, together with Gleditschia triacanthos and Robinia, is particularly adapted to desert-culture on account of its possessing tissues in which water is easily retained; but he gives no anatomical details to support his view. — (*Comptes rendus*, April 16.) G. L. G. [940

(*Systematic.*)

The Pomaceae. — Wenzig of Berlin gives a conspectus of the genera and species of this group as defined by him, — an abstract of his previous papers in *Linnaea* and elsewhere. According to his views, our species of Pirus appear under Malus and Sorbus, while Crataegus is merged in Mespilus. Crataegus spathulata, C. aestivalis, and C. arborescens, however, are referred to Cotoneaster; and for C. cordata he forms the genus Phalacros. He admits four American species of Amelanchier. — (*Jahrb. bot. gart. Berlin*, 1883.) S. W. [941

The Turneracae. — A very complete monograph of this order has been made by Urban of Berlin. Bentham and Hooker recognize three genera (Turnera, Erblichia, and Wormskioldia), which are all united by Baillon under Turnera. Urban defines five genera, restoring Piriqueta (of which Erblichia is made a section) and Streptopetalum, and adopting Balfour's recent genus, Mathurina. Piriqueta is characterized mainly by the presence of a corona upon the throat of the calyx, — an organ not previously observed, and important as confirming the close relationship of the order to the Passifloraceae. Eighty-three species are described, mostly belonging to Turnera and Piriqueta and to the warmer regions of America, from Carolina and Mexico to the La Plata, but chiefly Brazilian. The other small genera are confined to Africa; the monotypic Mathurina, to Rodriguez Island. The single species found within the United States, but occurring, also, in the West Indies and Brazil, is referred to Piriqueta (P. Caroliniana, Urban). In Mexico are found one species of Piriqueta and three of Turnera, the 'Damiana' (T. aphrodisiaca, Ward) being made a variety of the widely distributed T. diffusa of Willdenow. — (*Jahrb. bot. gart. Berlin*, 1883.) S. W. [942

ZOÖLOGY.

Tentacles of the Physalia. — Commodore Phelps, U.S.N., is contributing a series of articles under the title 'Reminiscences of the old navy,' one of which contains a notice of a Portuguese man-of-war captured in the harbor of Porto Grande, St. Vincent's Island, Cape de Verdes, whose tentacle was a hundred and seventy-five feet long. Notes are also given on the steamer-duck, the enormous spider-crabs of the Straits of Magellan, and on the life of the albatross. A fine large specimen of the latter was caught off the La Plata River in 1844, and marked. It was again caught in 1868. — (*United serv. rev.*, March.) C. E. M. [943

Protozoa.

Parasitic monads in the blood of fishes. — Mitrophanow has found two species, which he describes as new flagellate monads. They were obtained — one from Cobitis fossilis, the other from Barassius vulgaris — by letting the animal's blood flow into a half-per-cent salt solution. The parasite of the first-named fish occurs in several varieties, and is named Haematomonas cobitis. It is worm-shaped, pointed at both ends, has a flagellum on the front end, and an undulatory membrane on the side. It is 30 to 40 μ long, and 1 to $1\frac{1}{2}$ μ thick, and is very active in its movements. The second species is named H. carassii, and differs from the first by its greater length and more developed membrane.

In connection with this subject, the author criticises Gaule's views regarding the cytozoa observed in the frog's blood, and expresses his agreement with Lankester's description of them as parasites, given in the *Quart. journ. microsc. sc.*, Jan., 1882. — (*Biol. centralbl.*, iii. 35.) C. S. M. [944

A social Heliozoon. — Dr. Joseph Leidy exhibited drawings, and described a singular Heliozoon recently sent to him from Lake Hopatcong, New Jersey. It occurs mostly in groups composed of numerous individuals, one of the bunches, of an irregular cylindroid shape, containing upwards of a hundred. They reminded one of a mass of tangled burrs. They remained nearly stationary even for twenty-four hours, and exhibited so little activity, that, without careful scrutiny, they might readily be taken for some inanimate structure. The individuals composing the groups appeared to be connected by mutual attachment of their innumerable rays, and none were observed to be associated by cords of protoplasm extending between the bodies of the animals, as seen in Raphidiophrys elegans. Some of the individuals were in an encysted, quiescent condition. The active specimens resembled the common sun-animalcule, and measured from 0.024 to 0.036 mm. in diameter. They were observed to feed on two species of Actinophrys. After some hours a few individuals appeared to have separated from the surface of one of the groups, but they were as stationary and sluggish as when in association with the others. — (*Acad. nat. sc. Philad.; meeting* April 24.) [945

Mollusks.

Italian Limaces. — These form the subject of a monograph by Lessona and Pollonera. The authors find nine Arionidae and twenty-nine Limacidae existing in Italy which have hitherto been much confused in publications on the subject. Of the thirty-eight species, twenty-two properly belong to Italy, which possesses thirteen of the others in common with the continent of Europe. One is common to all the

shores of the Mediterranean, and two are cosmopolitan. The dentition and anatomy form the subject of two chapters, and are well illustrated. — (*Mem. acad. sc. Torino*, ii. xxxv.) W. H. D. [946

Molluscan fauna of Sardinia. — The land and fresh-water shells collected by Caroti and others on the island of Sardinia are treated of by the Marquise Paulucci in a separately reprinted paper. The island possesses thirty-one peculiar species, and one hundred others, which are also found elsewhere. The work, which is of a systematic and faunal character, is believed to be very complete, and extends to 247 pages and 9 plates. — (*Bull. soc. mal. ital.*, 1883.) W. H. D. [947

East-Indian Pulmonata. — Godwin-Austen, some time since, published an article in explanation of a plate prepared from drawings by the lamented Stoliczka, of rare and curious land-mollusks, which the latter had observed in a living state during his explorations. In this way some valuable data were made available for students. He has now contributed another similar paper and plate in which species of Oxytes, Rotula, Macrochlamys, Euplecta, and Rhyssota, are represented. In the same publication, Möllendorf contributes several articles on Clausilia of eastern Asia, the Nicobars and Japan. — (*Journ. Asiatic soc. Bengal*, March, 1883.) W. H. D. [948

Crustaceans.

New species and variability of fresh-water Copepoda and Cladocera. — Under the deceptive title of 'Heterogenetic development in Diaptomus,' C. L. Herrick describes some varietal forms of species of Diaptomus, describes a new species of Epischura, and discusses the homologies of the limbs in the genus; remarks upon entozoic parasites of Entomostraca, mentioning the occurrence of such parasites in Cyclops and Daphnia; and describes new species of Cyclops, Daphnia, Scapholeberis, Simocephalus, and Ceriodaphnia, and some post-embryonal stages of Daphnia. The paper is illustrated by three plates. — (*Amer. nat.*, April, May, 1883.) S. I. S. [949

Crustacea in the Leyden museum. — Dr. J. G. DeMan, in No. 3 of his Carcinological studies, gives notes on a number of species of Portunidae and Ocypodoidea, most of them from the East Indies and the west coast of Africa, and describes a new Geothelphusa from Java, and two new species of Sesarma from the west coast of Africa. He adds Plagusia depressa to the small but increasing number of species of world-wide range, extending its habitat from the West-Indian region to the west coast of Africa and Amboina. — (*Notes Leyden mus.*, v. 150.) S. I. S. [950

Arachnids.

Polymorphism and parthenogenesis of acarids. — In an article on the gamasids, Berlese begins with a *résumé* of the anatomy of the group, and then reports his observations on the development of these animals. In this family nearly one hundred species have been described, but many of them are only polymorphic forms. An adult form may be reached through two series of metamorphoses. One is short, comprising only the larva, nymph and adult: it may be called the 'normal' series. In the long or 'abnormal' series the number of forms is greater, because a variable number of generations may intervene. Thus, to give an example, Gamasus tardus produces a larva which changes into a nymph, and the nymph into the adult tardus. Now, G. stercorarius also produces similar young stages; but the adult stercorarius may change into a nymph, and that nymph becomes a tardus. The nymphs cannot reproduce. Moreover, stercorarius may be produced either directly, or by metamorphosis of another apparently adult form. The order of change cannot be reversed. Except in the final form, parthenogenetic reproduction seems to be common; and perhaps the impregnated eggs alone and always produce males. No morphological character has been detected by which the final forms may be distinguished from the reproducing-nymphs. For this reason no new species of this family can be described until the metamorphoses have been completely worked out.

Berlese has worked out three species, — Gamasus tardus, stabularis, and coleoptratorum. In each there are three different nymphs, each of which has its two sexual forms, besides which are the larva and the two sexual adults, making twelve forms in all. Finally there may be other intermediate varieties.

Berlese has also observed a true paedogenesis, in that the nymphs of Tachynotus inermis in one developmental series change directly into the adult, but, in the second, produce an egg, although they have no sexual orifice. — (*Arch. ital. biol.*, ii. 108; *Bull. soc. ent. ital.*, xiv. 88.) C. S. M. [951

Insects.

The Lucanidae of the United States. — Fuchs issues in a separate form, with a plate, his synopsis of this group, which the Brooklyn entomological society has been publishing by instalments in its bulletin. Enlarged figures are given of the antennae of each of the fourteen species. [952

The European Lixidi. — The biology, and particularly the food-plants, of the insects of this group in its various stages, are given in a tabulated form by Bargagli. Their food is shown to be largely composed of thistles. — (*Bull. soc. ent. ital.*, xiv. 312.) [953

Thorax of Diptera and Hymenoptera. — Brauer compares the thorax of Diptera and Hymenoptera, and concludes that no part of the first abdominal ring ever enters into the formation of the thorax of the former. Latreille's 'segment médiaire' is to be met with only in Hymenoptera. Hammond's view, that the metanotum disappears in the imago of Diptera, is found untenable; and the thorax is composed exactly as in Lepidoptera and Cicada. The thoracic stigmata belong to the meso- and metathoracic rings. Unfortunately the three accompanying plates are very obscurely drawn. — (*Sitzb. akad. wissensch. Wien*, lxxxv.) E. B. [954

Color-preferences of insects. — Bennett and Christy have added a considerable number of careful observations to those already recorded, on the habits of insects when visiting flowers, which show, that, as a general thing, butterflies do not confine themselves to a single species in many successive visits; while flies are more constant, and bees, especially Apis, are markedly so. Lepidoptera seem most fond of red or pink, and of other colors in the following order: yellow, blue, and white. The preferences of Diptera are white, red or pink, yellow; and, of Hymenoptera, generally red or pink, blue, white, yellow. Bombus selects colors in the order, red, blue, white, yellow. — (*Nature*, March 29.) W. T. [955

VERTEBRATES.

Histogenesis of nerve-fibres. — His has studied this subject on human embryos. In one only, 2.15 mm. long, it was found that the nucleated bodies of the cells of the medullary plate were already more

crowded towards the central canal, early marking the central position of the ganglion-cells. The cells send out processes, most of which extend radially: hence the majority of the cells, but not all, are bipolar. Perhaps the irregular outrunners are amoeboid processes. There is at this stage nothing which can properly be called nerve-fibres. In an embryo of five millimetres length, the number of cells in the spinal cord is greatly increased. They lie closer together, thickest centrally; and their nuclei, except in the peripheral portion, have for the most part their long axes running radially. Throughout the cord there is a system of radial fibres, many of which may be seen to be prolongations of the cells. The fibres form a more or less well-marked external layer around the cord; their external ends generally present a trumpet-like enlargement. The roots of the nerves are formed by the outgrowth of these fibres. The motor roots are first developed. They appear first as processes of the ventral cells of the cord, penetrate the limiting membranes, and so enter the body-wall. The posterior roots arise later. His believes that the cells which Balfour, Sedgwick, and others have described as forming the beginning of the roots are merely those which grow out to become the ganglion-cells distributed in the course of the nerves. — (*Arch. anat. physiol., anat. abth.*, 1883, 163.) C. S. M. [956

Reptiles.

Characters of the Hadrosauridae. — Professor Edward D. Cope, after giving a sketch of the classification of the Dinosauria, described in detail the characters of Hadrosaurus and the allied genus Diclonius. The species of the latter, upon which his observations were made, is the Diclonius mirabilis of Leidy, which is represented in Prof. Cope's collection by a nearly complete skeleton, including the skull from the Laramie beds of Dakota. In life, this species presented the kangaroo-like proportions ascribed by Leidy to Hadrosaurus Foulkii. The anterior limbs are small, and were doubtless occasionally used for support, and rarely for prehension. This is to be supposed from the fact that the ungual phalanges are here hoof-like, and not claw-like, though far less ungulate in their character than those of the posterior foot. The inferior presentation of the occipital condyle shows that the head was borne on the summit of a vertical neck, and at right angles to it, in the manner of a bird. The head would be poised at right angles to the neck when the animal rested on the anterior feet by the aid of a V-like flexure of the cervical vertebrae. The general appearance of the head must have been much like that of a bird.

The nature of the beak, and the dentition, indicate for this strange animal a diet of soft vegetable matter. It could not have eaten the branches of trees, since any pressure sufficient for their comminution would have thrown the slightly attached teeth of the lower jaw out of place, and have scattered them on the floor of the mouth. It is difficult to understand, also, how such a weak spatulate beak as these animals possessed could have collected or have broken off boughs of trees. By the aid of its dentate, horny edge, it may have scraped leaves from the ends of branches; but the appearances indicate softer and less tenacious food. Could we suppose that the waters of the great Laramie lakes had supplied abundant aquatic plants without woody tissue, we should have the conditions appropriate to this curious structure. Nymphaea, Nuphar, Potamogeton, Anacharis, Myriophyllum, and similar growths, could have been easily gathered by the double spoon-like bill, and have been tossed by bird-like jerks of the head and neck back to the mill of small and delicate teeth. In order to submit the food to the action of these vertical shears, the jaws must have been opened widely enough to permit their edges to clear each other, and a good deal of wide gaping must therefore have accompanied the act of mastication. This would be easy, as the mouth opens, as in reptiles and birds generally, to a point behind the line of the position of the eye, which was evidently of large size. On the other hand, the indications are, that the external ear was of very small size. There is a large tract which might have been devoted to the sense of smell; but whether it was so or not is not easily ascertained.

We can suppose that the huge hind-legs of Diclonius and Hadrosaurus were especially useful in wading through the water that produced their food. When the bottom was not too soft, they could wade in to a depth of ten or more feet, and, if necessary, drag aquatic plants from their hold below. Fishes might have been available as food, when not too large, and not covered with bony scales. Most of the fishes of the Laramie period are, however, of this kind. The occurrence of several beds of lignite in the formation shows that vegetation was abundant. — (*Acad. nat. sc. Philad.; meeting* April 24.) [957

Mammals.

New character for the Arctoidea. — As further defining the Arctoidea, Flower's third group of the land carnivora, Mr. Jacob Wortman described a peculiarity of the tarsus of these animals, in which the astragalus articulates with the cuboid and the navicular. The character was constant throughout the group, and, he believed, had not before been indicated. — (*Acad. nat. sc. Philad.; meeting* April 24.) [958

ANTHROPOLOGY.

The Foulbes, Peuls, or Fellata. — The nomenclature of ethnology will have to be reduced to some system in a not very distant future. The Bureau of ethnology has endeavored to obtain a complete synonymy of the North American Indian tribes. The work has involved the time and talents of several specialists, and includes several thousands of titles. The names applied to tribes of men, to begin with, have in the hands of authors not always the same inclusion. These names are spelled variously by writers in the same tongue, and with greater variety by those of different tongue. Further, names are often given by the tribe themselves, meaning simply men, location, gens, or parentage; or by their neighbors, meaning all these in each language of tribes in contact; or also including terms of contempt. The reader, therefore, is not astonished to find Ful, Pul, Fulbe, Pouls, Peuls, Foulis, Folos, Foulbes, Fellata, Féllani, Fulan, Futa, etc., applied to those people in western and middle Soudan sprung from negro stock, on which have been ingrafted Arabic blood and religion. Herr Gottlob A. Krause has added somewhat to our knowledge of this people, and especially to their synonymy. They are called Fulan, Felata, by the Arabs; Jfullan, by the Tuaregs; Fillani, Fullani, by the Haussas; Maplatakai, by the Musgus; Felata, by the Kanuri of Bornu; Fulas, by the Mandinkas; Agoi, by the Dschumus of Joruba; Tschilmigo, by the Mossi; Kambumana, by the Gureshas; Folani, Fulga, by the Gurmas; Bale, by the Mfutas and Basutos; Fato, by the Hams; Abate, by the Shukus; and Goi, by the Rupes or Tapas. — (*Das Ausland*, March 3, 1883.) J. W. P. [959

Dialects of Bolivian Indians. — In the northwestern part of Bolivia, along the rivers Beni, Mamore, and Yacuma, live the Cayuába, Mobíma, Canichána, and Trinitaria Indians, who have come under

the influence of civilization. On the east side of the Mamore, from Exaltacion as far north as the mouth of the River Guapore, or Itenez, are the wild Houbarayos, and opposite them the Chacobos. The Cangaparangas are near the head of steamboat navigation on the Madeira. On the River Beni, between 11° and 12° south, is the small tribe of Pacaváras. Their skin is almost white. The Araunas, who are to be found on the banks of the Madre de Dios, are no doubt cannibals. The civilized Tacanas live in the village of Tumupasa, on the River Beni, and eighteen miles north-west of them, in the village of Ysiamas, the uncivilized members of the same tribe. In the little town of Reyes, opposite to them, on the Beni River, are the Marópas, related to the Tacanas. Forty miles up the Beni is the mission of Muchanes; beyond that, Santa Ana; and, farther on, Covendo; in all of which are the Moseténa Indians. In the description of these tribes, Dr. E. R. Heath gives the Smithsonian vocabulary for the Canichána, Cayuába, Mobíma, Marópa, Moseténa, Pacavára, and Tacana. — (*Kansas city rev.*, April.) J. W. P. [960

(*Folk-lore.*)

Folk-lore in Europe. — A noteworthy activity in the field of folk-lore is shown throughout Europe at present. The annual proceedings of the Portuguese folk-lore society have been recently issued at Oporto, edited by De Vasconcellos, author of *Tradicoes populares de Portugal*, and of a considerable number of folk-tales published within recent years.

Italy has done much for folk-lore since 1869, having furnished nearly one thousand folk-tales, and such important works as those of De Gubernatis. Palermo now gives us a folk-lore journal, the *Archivio per lo studio delle tradizioni populari*, edited by L. Pedone-Lauriel.

In France much is done, both in collecting and publishing. Maisonneuve & Co. are issuing a series of works on the folk-lore of all nations. Among the most important that have appeared are Sebillot's *Littérature orale de la Haute-Bretagne; Traditions et superstitions populaires de la Haute-Bretagne;* and Luzel's *Légendes chrétiennes de la Basse-Bretagne.* The same house publishes a folk-lore almanac, the second volume of which has appeared. Besides other interesting matter, this almanac contains the addresses of continental and English folk-lorists, and a carefully compiled folk-lore bibliography of the year.

In Germany and the Slav countries the work of collecting and publishing folk-lore is continually carried on with more or less activity. — J. W. P. [961

The folk-lore society of London. — The *Folk-lore journal*, now in its first year, was established by the Folk-lore society of London to satisfy a want felt for some time. Folk-lore, in the comprehensive sense of the term as now used, is growing in the world's esteem every year, and will continue to grow in proportion as its real scope and value become known. The establishment of this monthly journal was therefore most opportune, and will be welcomed by students of the mental history of mankind. Each number consists of thirty-two pages, octavo, containing generally four articles, and concluding with notes, queries, notices and news, all relating to folk-lore. To this may be added three pages of book advertisements and criticisms printed on the cover. The subjects treated in the first four numbers are: The oratory, songs, legends, and folk-tales of the Malagasy; Babylonian folk-lore; A building superstition; Stories of fairies from Scotland; Folk-tale analysis; Irish folk-tales; Bibliography of folk-lore publications in English; The hare in folk-lore; Anthropology and the Vedas; Index to the folk-lore of Horace; Some marriage customs in Cairnbulg and Inverallochy. — J. W. P. [962

Folk-lore. — The Folk-lore society of London has undertaken an analysis and classification of the folk-tales of all nations. This very important and difficult task has been intrusted to a committee, which has entered upon its labors, aided by several members of the society, who have volunteered their assistance. It is believed that a thorough analysis will reveal the root-stories and their derivatives in the various cycles of folk-tales throughout the world. When these root-stories are discovered, they are to be classified in a satisfactory system, and their derivative stories ranged under them. At a later period, myths, god and hero tales, may be treated in a like manner. A good classification of the folk-tales and myths of mankind would be a monumental work of usefulness. The efforts of the society will be watched with interest. — J. W. P. [963

Brazilian folk-lore. — Though no efforts are made in South America to collect the languages or lore of the aborigines, a volume of Brazilian folk-lore is announced for early publication in Lisbon, under the title of *Contos populares do Brazil*, by Theophile Braga. Though called Brazilian, this collection will, of course, be essentially Portuguese in character.

In the United States we have never made a collection of European-American folk-lore. But trained scholars are now making for the Bureau of ethnology a collection of the folk-lore of the North-American Indians, which, beyond doubt, will be one of the most interesting contributions offered to science for many years. — J. C. [964

Folk-lore dinners. — In 1882 a series of dinners was arranged in Paris to enable folk-lorists to meet in a social and informal manner. During the year four of these symposia were held, presided over by Messrs. Gaston Paris and Loys Bruyère. The same number will be given this year. They are called the dinners of '*Ma Mère l'Oye*' (Mother Goose dinners), and, judging by the accounts, are a decided success. It is suggested to the London society, by one of its members, to follow the example of the French. — J. C. [965

EGYPTOLOGY.

Bibliography. — The intellectual activity engaged, and the progress made, in oriental studies during the year 1882, is strikingly exhibited in the "Bibliotheca orientalis, or a complete list of books, papers, serials, and essays, published in 1882 in England and the colonies, Germany and France, on the history, languages, religions, antiquities, and literature of the east, compiled by Ch. Frederici, Leipzig, London, Paris, New York," 79 p. 8°. The whole number of titles given is 1,284, but, allowing for titles repeated, there still remain between 1,100 and 1,200 publications in 1882 on the east. Of these, 120 were devoted specially to Egypt, and include the weighty names and important works of Leemans, Birch, Brugsch, Chabas, Dümichen, Ebers, Erman, Golenischeff, Lefébure, Lepsius, Mariette, Maspero, Naville, Perrot, Piehl, Pierret, Renouf, Revillout, Schiaparelli, Stern, *et al.* In some schools of Semitic philology it is the fashion to speak contemptuously of Egyptology; but it would not appear to be the part of wisdom to pit pure philology against innumerable stone monuments with legible inscriptions plus a philology represented by an array of scholars the equals in all respects of their detractors. Semitic scholars, with other scholars of antiquity, must accept the well-founded results of cautious study of the monuments of Babylonia and Egypt, or they will find the flood upon them. — H. O. [966

INTELLIGENCE FROM AMERICAN SCIENTIFIC STATIONS.

GOVERNMENT ORGANIZATIONS.

National museum.

A new sperm-whale. — The Smithsonian institution has recently received from Life-saving service No. 84, at Spring Lake, New Jersey, a very valuable specimen of a pygmy sperm-whale of the genus Kogia. This is apparently the first instance of the discovery of a cetacean of this genus in the North Atlantic. Five species have been hitherto described, — three from the Australian waters, one from the Cape of Good Hope, and one from the Gulf of California. The recently acquired specimen differs from Kogia Floweri, apparently the most closely allied species, in having less incurved teeth, longer pectorals, a higher dorsal, and the symphysis of the lower jaw more convex below. It may be denominated Kogia Goodei.

The specimen has been photographed and cast, and the viscera have also been preserved. The animal proved to be with young, the foetus measuring about three feet in length. F. W. TRUE.

Bureau of ethnology.

Prehistoric remains in North Carolina. — Mr. John P. Rogan and Dr. J. Mason Spainhour have made some important finds of antiquities in North Carolina. In one mound they found there had been sixteen persons buried, ten of them in stone graves or cists, not of the usual form, but built up in a conical shape of small stones, arched over, and closed at the top. In nine of these the skeletons were sitting upright. It appears, that before the burial the ground, to the full size of the mound, had been excavated to the depth of about three feet; the bodies were then placed in a sitting-posture, and the stone tombs built over them. At the centre, a small round hole had been dug some three feet deeper, a body had been placed therein in a standing-posture, and the tomb built up around it so as to cover the head; the capstone being a large piece of steatite. Immediately under this, on top of the head, were several plates of cut mica. At one point in this mound was found an oblong structure, 24 inches long, 18 inches wide, and 18 inches high, built up solidly of river-stones. No implements or other articles, except a few broken pipes, were found in this mound.

A short distance north of this was discovered a triangular enclosure filled with graves, some of them incased with stone, others not. In some of these graves there were two skeletons, one placed above the other; the lower one in each case being of small stature, with very heavy flat stones placed on the arms and legs.

In one large grave were found ten skeletons, the principal one with the face downwards. Under his head was a large engraved shell; around his neck, the remains of a necklace of large-sized beads; at each ear, pieces of copper; around each wrist, bracelets composed of copper and shell beads; on his breast, a piece of copper; at his right hand, two implements of hammered iron; under his left hand, an engraved shell filled with beads of various sizes. The other nine skeletons were arranged around this one, extending in all directions; under two of them were also found engraved shells. Scattered over the area were found a number of stone axes, polished celts, descoidal and rubbing stones; a number of steatite pipes highly polished, with bowl and stem of one piece; also copper arrow-heads, plates of mica, graphite, etc.

These articles have all been received by the bureau. The same parties have since opened another mound, in which were found fifty-five skeletons, four or five engraved shells, copper beads, a piece of hammered iron, pots, cups, one tomahawk, a number of stone implements, about a dozen pipes, mica, galena, etc.

Department of agriculture.

Artesian wells. — The work under the department for the sinking of artesian wells in the arid lands of the west, is going steadily on. A recent report from artesian well No. 1, at Akron, Col., gives the following state of affairs, — Feb. 23, a depth of 925 feet had been reached with 1,063 feet of casing in, as follows: 100 feet of 10-inch, 293 feet of 8-inch, and 670 feet of 6-inch. The character of the formations has been, 10 feet clay and gravel, 10 feet gravel, 10 feet, of a chalky deposit, 50 feet conglomerate (sand and gravel), 8 feet hard sand rock, 20 feet chalky rock 12 feet gravel and clay, 92 feet dry black clay, 10 feet sandstone, 113 feet blue slaty shale, 570 feet shale. At 50 feet a small amount of water was found, at 100 feet the water rose 15 feet, at 128 feet it rose again slightly, at 355 feet there was a rise of 80 feet, and at 540 feet the water rose again 305 feet.

STATE INSTITUTIONS.

Ohio meteorological bureau, Columbus.

Weather report for March. — The atmospheric pressure was generally less than for any month yet reported by this bureau. The maximum barometric height (30.619 inches), the mean (30.060 inches), and the minimum (29.424 inches), are all less than the corresponding figures for previous months. Both the maximum and minimum are reported from the lake region, the former having been observed at Oberlin, and the latter at Sandusky.

The remarkable feature of the weather for the month was the extremes of temperature that were recorded, and the unusually low mean for the whole month over the whole state. This mean was 32.4°. In a series of temperature observations extending over periods of from six to twelve years, and fairly well distributed over the state, the mean temperature for the month of March is found to be about 38°, so that the past month must be regarded as unusually cold. The extremes of temperature are even more remarkable. A maximum of 75° is reported from Ironton on the 18th, and a minimum of 17.4° below zero at Wauseon on the 20th. This makes a range for the state of 92.4°, which is above any previously reported, and one not likely to be reached again during the year. The fall of temperature about the 18th, 19th, and 20th, was extraordinary. Wauseon reports the maximum daily range, which was 55.2° on the 18th. This station has continuously reported the lowest temperatures. During the past four months the lowest points reached have been as follows: —

	Temperature below zero.
Wauseon, December	16.4°
" January	17.5°
" February	12.0°
" March	17.4°

From this it will be seen that the temperature

reached on March 20 was only one-tenth of a degree higher than the lowest for the season. It is hardly to be expected that Wauseon will continue furnishing such records as this. The mean daily range of temperature over the whole state was 19.2°, which is also unusually great.

The amount of precipitation during the month was less than is usual for March. The mean depth of rain or melted snow was 2.18 inches, while the mean of observations extending over several years is 3.17 inches for the month of March. Rain or snow fell, on an average over the whole state, on twelve days in the month. A thunder-storm of considerable violence, and covering a considerable area, occurred on the evening of the 14th. Westerly winds prevailed.

Missouri weather-service, St. Louis.

Weather report for April. — The average temperature of April has been 56.7° at St. Louis, which is about half a degree above the normal of Engelmann's series. Since 1837 the mean April temperature has once reached 66.8° (in 1844), and in 1857 it fell to 44.1°, a range of 22.7°. The extremes during the last month have been 32.2° (on the 24th) and 85.6° (on the 14th), which are very ordinary temperatures. In April, 1857, the lowest daily minimum was 18°; while in the years 1838, 1843, and 1855, the highest maximum reached was 93°. In the state the maximum temperature has been the highest in the central part, Glasgow reporting 93°, Miami 92°; while at Cairo, Ill., the highest temperature reached was 84.5°, that at Keokuk being 85°. The lowest minimum reported was 22°, at Centreville; and twelve stations out of twenty-one reported the minimum as 32° or below.

The rainfall at the central station has been 2.62 inches, the normal rainfall being 3.70 inches. At the St. Louis water-works, however, the rainfall has been 3.87 inches. The rainfall has been heaviest, or more than 5 inches, in the extreme south-eastern part of the state. In the central-western part, and in a narrow belt extending therefrom to Macon and Shelbina, the fall has been less than 1 inch, while in the north the fall has been over 2 inches. At four P.M. on the 14th a severe local storm, which was apparently an incipient tornado, did considerable damage at Hannibal. Its track was about three hundred feet wide. Similar storms, with hail, were observed seven miles west and ten miles north of Mexico. A small tornado having a width of fifty to seventy feet, passed through the western part of Pleasant Hill between half-past seven and eight A.M. A portion of a rail fence was carried eight feet, and set down without materially changing the relative positions of the rails.

In the dry area of the past month, where ice-crust did damage to the wheat during the winter, additional damage has been done by the drought and high winds of the past month. At Savannah not over one-tenth of a crop is left, and farmers are planting the ground in corn. Meadow is also light. In the south-eastern part, however, the plentiful rains have repaired to some extent the damage done to wheat, and it is turning out better than was expected. Thus far the fruit-crop has not been materially injured by frost, the cool and uniform temperature having been very favorable.

State university of Kansas, Lawrence.

Weather report for April. — During this month the temperature was high, the rainfall was a full two-thirds of the normal quantity, and the cloudiness, wind-velocity, and humidity were each considerably below the averages. The only frost was a harmless hoar-frost on the 24th. All kinds of fruit-trees were in blossom from the 10th to 30th.

Mean temperature, 57.18°, which is 3.17° above the average April temperature of the fifteen preceding years. Highest temperature, 89.5°, on 13th; lowest, 35°, on 24th; monthly range, 54.5°: mean at 7 A.M., 51.02°; at 2 P.M., 67.7°; at 9 P.M., 55°.

Rainfall, 2.12 inches, which is 0.92 inch below the April average. Rain fell on nine days. There was no snow. There were two thunder-showers. The entire rainfall for the four months of 1883 now completed has been 6.44 inches, which is 1.31 inches below the average for the same period in the past fifteen years.

Mean cloudiness, 40.11 % of the sky, the month being 8.80 % clearer than the average. Number of clear days (less than one-third cloudy), 16; entirely clear, 6; half-clear (from one to two thirds cloudy), 9; cloudy (more than two-thirds), 5; entirely cloudy, 2: mean cloudiness at 7 A.M., 45.67 %; at 2 P.M., 43.33 %; at 9 P.M., 31.33 %.

Wind: S.W., 22 times; S.E., 20 times; N.W., 17 times; S., 13 times; E., 3 times; W., 3 times; N.E., 12 times. The entire distance travelled by the wind was 12,936 miles, which is 1,248 miles below the April average. This gives a mean daily velocity of 431 miles, and a mean hourly velocity of 17.96 miles. The highest velocity was 50 miles an hour, on the 14th. Mean velocity at 7 A.M., 15.60 miles; at 2 P.M., 22.40 miles; at 9 P.M., 15 miles.

Mean height of barometer, 28.957 inches; at 7 A.M., 28.969 inches; at 2 P.M., 28.917 inches; at 9 P.M., 28.984 inches; maximum, 29.473 inches, on 24th; minimum, 28.289 inches, on 22d; monthly range, 1.184 inches.

Relative humidity: mean for month, 53.33; at 7 A.M., 64.7; at 2 P.M., 36.7; at 9 P.M., 58.6; greatest, 100, on 5th; least, 10.5, on 17th and 24th. There were two fogs.

NOTES AND NEWS.

The first meeting of the Ohio state forestry association was held in Cincinnati, April 25 and 26. Several papers upon tree-planting and forestry were read; the most elaborate, based upon the preliminary publications of the tenth census, being that of the United States commissioner of agriculture. The meeting, however, if we may judge from the meagre reports published in the Cincinnati papers, produced no new facts about forests or forest management, and quite failed to arouse any local enthusiasm.

It is difficult to decide how far these forestry conventions, of which several have been held during the past year or two in different parts of the country, serve the cause their promoters desire to foster. Forest preservation has become, from various points of view, a question of great national importance for the United States. Economists are properly alarmed at the prospect of a speedy exhaustion of some of our most valuable varieties of lumber, although the more serious dangers which threaten the country through the effects of improper forest destruction upon the flow of rivers and agricultural prosperity have hardly yet received proper attention.

Conventions of self-termed 'friends of the forest' have thus far failed to bring about any reform in the

management of the forests of the country, whether private, or situated on the public domain. But as such meetings serve to keep the general subject before the public, it would not be fair to say that they have not some value. Forest orators at these meetings invariably deplore the want of an American system of forestry, and declare that such a system must be provided at once. We are not sure that we exactly know what they mean by an American system of forestry (it would indeed be an elastic system which would be equally applicable to the forests of Florida and Michigan); but it is safe to predict, that, if our forests are ever managed under any sensible system which will secure the greatest benefit from them for the whole community, such a system will be reached through scientific investigation, quietly pursued along lines of definite research, and not by the teachings of enthusiasts who attend conventions, and find it easy to tell us all about forests, and what they do in Europe to preserve them.

— At the meeting of the Washington anthropological society, held May 1, Mr. Albert S. Gatschet gave an account of his recent journey to the Shetemacha Indians in southern Louisiana, near and on the Gulf coast. Once these people were very powerful in this region; but they are now reduced to a handful, very much mixed, the younger ones even refusing to learn the mother-tongue. Many of their old practices yet prevail; but the innovation of new ways and words upon the old gives a most instructive lesson upon the growth of civilization. At the same meeting, Professor Cyrus Thomas made a report upon a map of mound distribution which he is preparing under the direction of the Bureau of ethnology. The plan has been to collect and classify from every available source the mounds enumerated in each state where they exist. From these data the map has resulted.

— The mathematical section of the Washington philosophical society, April 26, heard the conclusion of Mr. Kummell's discussion of alignment curves, and Prof. A. Hall on The determination of the mass of a planet from the relative observation of two satellites. May 9 Mr. M. H. Doolittle read a paper on Infinitesimals and infinites, which gave rise to considerable discussion as to the true meaning of these terms. Mr. E. B. Elliott then explained the construction of perpetual calendars.

— The Philosophical society of Washington, at its meeting, May 5, listened to Mr. H. A. Hazen on Hygrometric observations, and Mr. E. J. Farquhar on Dreams in their psychological relation.

— The Natural history society of Toronto has just elected as office-bearers for the coming year, Dr. Brodie, president; Messrs. Pierce and Seaton, vice-presidents; Mr. Williams, recording secretary; Mr. Clare, corresponding secretary; and Mr. Mosey, curator and librarian. The question of the usefulness of the English sparrow was brought up at the last meeting by Mr. Henry Melville, who urged the society to petition the Canadian government to furnish such material assistance as might enable the society to secure practical results.

— At a meeting of the Department of science and arts of the Ohio mechanics' institute, held May 10, Mr. George W. Bugbee read a paper on the Manufacture of small fire-arms, which was illustrated by models and blackboard drawings; and Dr. F. Roeder exhibited a method of purifying muddy water by means of dyalized iron.

— At the meeting of the Biological society of Washington, May 11, communications were made by Prof. L. F. Ward, on some hitherto undescribed fossil plants from the lower Yellowstone, collected by Dr. C. A. White in 1882; by Mr. Frederick W. True, on a new pygmy sperm-whale from the New Jersey coast; and by Dr. Thomas Taylor, on Actinomykosis, a new infectious disease of man and the lower animals, with exhibition of a portion of the diseased viscera of a dog containing specimens of the fungus Actinomyces.

— The annual report of the North Carolina agricultural experiment station is very largely composed of the results of analyses of commercial fertilizers, and of amateur field-experiments on their use. Some of these have been previously published in the form of bulletins, and have been noticed in our columns. A few fodder-analyses are also given, among them some of the by-products of cotton-seed and rice, an account of which appears in another column; and a field-experiment with cotton is reported, giving the interesting result that too heavy manuring with nitrogen (on poor land) actually decreased the crop of cotton, presumably by unduly stimulating the growth of the vegetative organs.

— A meeting of the United States naval institute was held at Annapolis on May 10, at which the prize essay of '83 was discussed, and Professor Charles E. Munroe read a paper on the Drying of gunpowder magazines.

— Mr. E. W. Nelson, who arrived in Washington last week for the purpose of completing his report upon the ethnology and zoölogy of Alaska, has suffered a decline in health, and will be forced to return to Colorado immediately.

— Dr. Tarleton H. Bean will go to London in June, to be present at the Fisheries exhibition, and to prosecute some important studies in ichthyology in co-operation with Professor Goode. He will probably visit the principal museums on the continent.

— The treasurer of the American committee of the Balfour memorial fund acknowledges the following subscriptions: Dr. S. Weir Mitchell, Philadelphia, $25; Roswell Fisher, M.A., Cantab, Montreal, $5; Dr. T. W. Mills, McGill college, Montreal, $2. Previously acknowledged, $486.25.